RESEARCH REPORT

DEMOGRAPHIC CHANGES AND REAL HOUSING PRICES IN CANADA

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101-01623/

Demographic Changes and Real Housing Prices in Canada

Report prepared for
Canada Mortgage and Housing Corporation

By
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October 1999

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Cette publication est aussi disponible en français sous le titre : *Les changements démographiques et le prix réel des logements au Canada.*

This research project was funded by Canada Mortgage and Housing Corporation CMHC. The contents, views and editorial quality of this report are the responsibility of the author(s) and CMHC accepts no responsibility for them or any consequences arising from the reader's use of the information, materials and techniques described herein.

Canadian Cataloguing in Publication Data

Fortin, Mario

Demographic changes and real housing prices in Canada

Issued also in French under title : Les changements démographiques et le prix réel des logements au Canada.
Includes bibliographical references.
ISBN 0-0660-18243-2
Cat. No. NH15-366/2000E

1. Housing -- Prices -- Canada.
2. House Buying -- Canada -- Costs.
3. Housing -- Economic aspects -- Canada.
4. Housing forecasting -- Canada.
5. Population -- Canada.
I. Leclerc, André.
II. Canada Mortgage and Housing Corporation.
III. Title.

HD7287.82C3F67 2000 333.33'823'0971 C00-980360-2

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Printed in Canada
Produced by CMHC

SUMMARY

With the aging of the baby-boom generation, the number of young households is falling in Canada. Foot and Stoffman recently suggested that in a population with fewer young generations, the number of homebuyers is bound to decrease, which will cause the prices of residential real estate to drop. This document attempts to verify the validity of this contention.

To this end, in chapter 2 the current real housing price determination model is reviewed, i.e. a demand equation and a stock variation equation. We show among other things that the demographic composition does in fact constitute a potential determinant of the aggregate housing demand. However, housing use costs, real household income and housing stock constitute other variables likely to influence housing prices. The model also shows that the long-term price reaction differs substantially from that of the short term because the long-term supply is elastic.

In chapter 3 the historical evolution of real housing prices in Canada at both the national and provincial levels is studied. The first part of this chapter evaluates the quality of the data available on housing prices. The conclusion is that the best source of comparable data at the provincial level and available for a long enough time period, i.e. since 1957, is the Multiple Listing Service (MLS) average sales price. The comparison with other price data, and especially the New Housing Price Index and the implicit housing activity deflator index, does lead to the belief that the MLS price overestimates the rise in the constant quality price because no adjustment related to the underlying growth in housing quality is made. The historical data confirm that real housing prices experienced strong growth in 1973 and 1974 and then again between 1985 and 1988. On the other hand, real housing prices decreased in 1981-82 and in the early '90s. These movements are seen in all of the price measurements considered except those indicating the sale price of homes insured under the *National Housing Act*, which does not capture the price increase in 1973 and 1974. This can probably be explained by the rules for eligibility to the insurance program.

To complete the historical overview, the evolution in the factors likely to influence housing prices is reviewed. To do this, the growth of the adult population is examined. Population was chosen over the number of households because the rate of household formation is not housing price independent. The growth in real income, with emphasis on identifying the periods of recession and expansion is studied, as well as the two main determinants of the housing use cost, namely the interest rate and the inflation rate. Lastly, this historical overview is completed by indicating the rate of growth in the number of dwellings.

Chapter 4 focuses on the debate arising from the publication in general interest magazines of Foot and Stoffman's findings. After presenting the authors' arguments, we look at the way they were received by real estate market analysts and generalists. It is easy to see the difference between the two audiences. While Foot and Stoffman's contention was well received in the press, the specialists almost unanimously stressed the importance of the other factors listed in chapter 2.

Chapter 5 presents a detailed review of the empirical studies on the relation between demographic changes and housing prices. The fundamental article is that by Mankiw and Weil (1989). The exceptional interest of their study is based on their sensational prediction that between 1990 and 2010, real housing prices would decrease by 47% because of population aging. This stems from the fact that housing consumption reaches a peak at age 40 and decreases thereafter. The drop in price will stem from the fact that the number of households over age 40 will increase while the number of those under age 40 will decrease. A series of subsequent articles, however, deflated this prediction. Several aspects of their methodology were criticized. Three key points in these reactions are worth pointing out. First of all, their methodology is incomplete in such a way that the omission of certain variables and one supply equation can explain the importance of the demographic variable. Next, their result seems specific to the United States since the same demographic importance cannot be identified in other countries. Lastly, the relationship they estimate between household age and housing demand is incorrect because one is confusing age effect and cohort effect. Far from reaching a peak at age 40, housing consumption seems to remain high right up to about age 70. Aging will therefore not reduce the housing demand.

In chapter 6, an empirical model containing a price equation and a housing stock equation is specified. This model is first estimated using Canadian data and then using provincial data. There is a significant effect from the growth in the population aged 25-54 on real housing prices. However, the adjustment dynamics indicate that this effect is temporary and that, in the long term, the stock variation allows for amortization of the price change. Furthermore, these dynamics are similar in the different provinces, even though the estimated adjustment speed and the value of certain coefficients vary somewhat. The main factor that determines the long-term change in real housing prices is the real income of the adult population. In fact, findings indicate that these two variables are co-integrated, which implies that they share the same stochastic shocks.

Finally, in the last chapter, an empirical model is used to evaluate the impact of demographics and the economic conditions on the change in housing prices during the 1956-1997 period, and to establish the housing price outlook for the 1956-2016 period. These forecasts consider three demographic growth scenarios and two economic growth scenarios to extract a set of 6 housing price and stock forecasts for the 1998-2016 period. This analysis shows that it is not very likely that the real price will experience a decline during this period. Weak economic growth would have to be combined with the low fertility and immigration scenario for prices to decline across Canada. In this case, the decrease would be small. It is more plausible to contemplate a modest rise in prices. However, the contention of declining prices becomes conceivable in the provinces or regions that will experience population shrinkage in the course of the next 20 years. Lastly, the model can easily be modified to make forecasts of different prices, according to other economic or demographic hypotheses.

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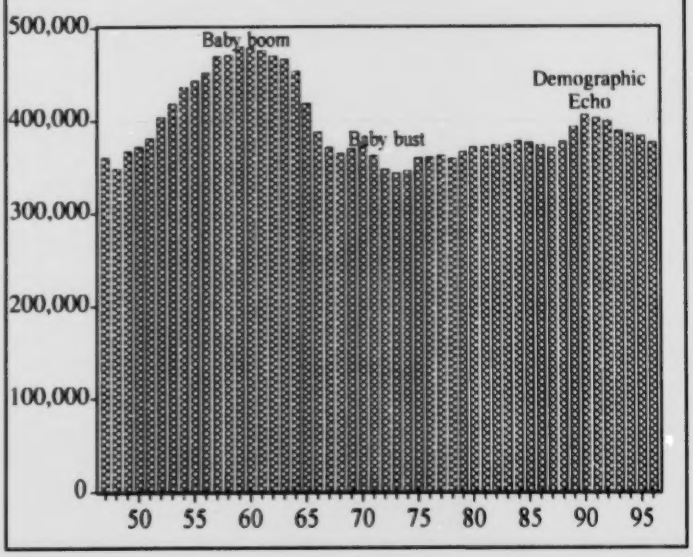
1. INTRODUCTION

After the Second World War, most of the Western countries experienced a resurgence in the number of births attributable to an increase in fertility rates. This phenomenon, called the "baby boom", was more noticeable in North America than in Europe. As shown in Figure 1, it is between 1955 and 1965 that the phenomenon reached its peak when more than 4.6 million births were registered in the country. However, this strong contingent was followed by a decline in fertility that was particularly rapid in the early '60s. Hence, between 1970 and 1980, only 3.6 million births occurred in the country, a drop of 22% in fifteen years. This low birth rate was the result of a low fertility index at the time when the number of women in their optimum child-bearing years was relatively low. This came to be known as the "baby bust".

When the baby boom cohort arrived at their maximum fertility years at the end of the '80s, we witnessed a temporary recovery in births, even though this generation's fertility was almost half that of the previous generation. This brief recovery in births was called the "demographic echo". In *Boom, Bust & Echo: How to Profit from the Coming Demographic Shift*, D. Foot and D. Stoffman analyze the repercussions of the aging population and the passage of the demographic wave on several aspects of Canadian society. It is mostly this impact on housing demand that draws our attention.

Figure 1
Births in Canada, 1946-1996



The Foot and Stoffman analysis is based on the typical profile of housing services consumption that can be illustrated as follows. From their early twenties, and for about a decade, young adults are, generally speaking, tenants in a multiple-unit residential building. This period allows them to finish their studies, form a union and save the downpayment required to buy a home. In their early thirties, households become first-time buyers. The exact age at which they will do this varies in the different regions, primarily because of the differences in housing prices. In the regions where prices for homes are higher, households buy their first home at a later age because they need to save more capital to cover the downpayment. The first home will typically be a single-family dwelling with several bedrooms to house the children. Over the next 20 years, housing needs vary little. However, as the household's income gradually rises and it accumulates more wealth, the "forty-something" household may look for a more spacious or better situated residence that will be more expensive than the first. Those who are more well-off may even look at acquiring a secondary home. Finally, when the household reaches retirement, we witness a return to the multiple-unit residential buildings.

This profile implies that the demographic wave first unfurled on the multiple-unit residential rental market in the '70s, with a maximum effect near 1980. The wave then pursued its course and reached its full effect on the homeowner housing

market towards 1990. The surf from this wave reached its trough fifteen years after its crest, when the baby-bust generation reached age 30. Hence, between 1990 and 2005, there is a decline of approximately 20% in the number of new households likely to become first-time homebuyers. Further into the future, around 2030, it is anticipated that a record number of households may wish to dispose of a single-family dwelling.

Foot and Stoffman base a real estate investment strategy on this scenario. They document the fact that the demographic movements are the key predictable changes. They then maintain that the housing price will react strongly to these demographic movements. More precisely, they foresee that when the baby-bust generation reaches the first-time homebuyer age, the real price of low-end suburban single family homes will be weaker. On the other hand, it must be anticipated that at the same time, the more luxurious homes will be much sought after and their price will be higher. These are the same homes that will be put on the market en masse when the baby-boom generation reaches retirement age.

In order to establish the plausibility of this scenario, the next chapter discusses the main factors that determine housing prices:

- price concepts (occupation versus purchase and the relationship between the two);
- role of real estate investment and long-term determination; and
- factors that determine the demand (real income, real interest rate, inflation rate, taxation).

Therefore, the real housing price determination model is presented first. In the following chapter, the historical evolution of the real housing price in Canada at both the national and provincial levels is presented. This chapter will be used to compare the data available on housing prices. Chapter 4 focuses on the debate kindled by the publication of the Foot and Stoffman text in general interest magazines. After presenting the authors' arguments, reaction to them by real estate market analysts and generalists will be evident. The next chapter presents a detailed review of the empirical studies on the relationship between demographics and housing prices. In the sixth chapter, the empirical model and interpretation of the national and provincial results are specified. Finally, in the last chapter, the empirical model is used to evaluate the comparative impact of demographics and the economic conditions on the evolution of housing prices during the 1956-1997 period and to establish projections for real estate prices, nationally and provincially, for the 1998-2016 period.

2. REAL HOUSING PRICE DETERMINATION MODEL

2.1 Housing Demand

The housing price is determined by market conditions. In a competitive market, these push the housing price to a level where the quantity in demand matches the quantity supplied. When demand is strong, the housing price rises, while it tends to shrink during periods of low demand. The equilibrium price will also react to changes in the supply and especially the construction costs.

For a competitive market to exist, the goods transacted in it must be perfectly comparable and mobile. Yet, dwellings are not totally comparable amongst each other. Some of their characteristics are intrinsic to the dwelling, especially the habitable floor space, the materials used, the interior divisions or the type of housing (single or multiple, single-storey or multi-storey). Others are environmental variables such as proximity to services and through streets, the type of neighbourhood or the terrain contours, to name a few. Since these environmental variables always differ from one dwelling to another, there are no two completely identical dwellings. The hedonistic approach circumvents the difficulties raised by the heterogeneity of the housing stock. The price a buyer is willing to pay for a dwelling is the result of the value he or she attributes to its characteristics.

Furthermore, the markets are incomplete.[1] This makes certain decisions inseparable that are at first glance independent. For example, because of the absence of an organized single-dwelling rental market, the decision to occupy such a dwelling implies the dwelling's purchase by the occupant. Yet, when the occupant is also the owner, he or she must consider the dual nature of the dwelling, which is both a consumer good and an investment good. This duality forces one to make the distinction between two price types, i.e. the price of the good, also called the acquisition cost, and the cost of the housing services. Since the latter measures how much it costs to occupy a dwelling for a certain time, it is also called the occupancy cost.

In this document, the focus is on the acquisition cost. However, the occupancy price and the acquisition price are interrelated by a ratio called the housing use cost. Several elements interact to determine the cost of use. To understand how they interact, it is useful to formalize without actually introducing a complicated algebra equation.

2.1.1 Housing Use Cost

The housing use cost U is the ratio between the cost of the housing services and the acquisition price. The cost of the services corresponds to the occupancy costs which the owner of the dwelling must assume during a given period. Among these components we find the maintenance expenses that include heating, electricity, municipal taxes, insurance, the physical upkeep and depreciation of the building. This group of expenses will be called Z. As a first approximation, it is more plausible to infer that these expenses are proportional to the value of the building P.[2] We can then write $Z=zP$, where z is a constant fraction.

In addition to the maintenance expenses, the occupancy cost depends on the cost of credit, which interacts in two ways. First of all, there are the mortgage loan interest expenses. If θ represents the ratio between the mortgage debt and the value of the dwelling, the mortgage debt is then θP. With a nominal interest rate i, the total interest paid becomes $i\theta P$. As for the owner's equity invested in the dwelling, an amount of $(1-\theta)P$, the owner is trying to earn a satisfactory return considering the risk. On first estimate, it can be inferred that a before-tax return comparable to the mortgage interest rate i is sufficient. The return desired on the equity is $i(1-\theta)P$. Generally speaking however, the literature admits that since the return on equity would be taxable if it were invested in other investments, the owner is satisfied with a return equal to the after-tax yield he or she may have made. If a marginal tax rate of τ is assumed, the satisfactory return on the owner's equity is then $i(1-\tau)(1-\theta)P$.

Finally, the owner deducts from these costs the anticipated capital gain on the dwelling ΔP. Since the capital gain on a principal residence is not taxable, this is an after-tax gain. By dividing all of these values by the asset price, we obtain equation 1, which gives the housing use cost in Canada:

$$U = z + i(1-\theta) + i(1-\tau)(1-\theta) - \Delta P/P$$
$$= z + i - i\theta(1-\theta) - \Delta P/P \qquad (1)$$

Equation 1 is subject to some individual variations. It actually shows that the cost of use decreases when the investment income tax rate is high. Because of the progressive tax rates, the high-income households therefore have a lower cost of use. The latter also decreases when the housing fraction financed by owner equity is greater, which is beneficial to households with greater financial wealth.

The housing use cost is likely to experience large annual variations. This variability is not primarily due to the maintenance expenses because the latter represent a fairly stable fraction. It is the macroeconomic instability that is the cause, due to the variations in interest rates and the inflation rate. Interest rates were particularly variable during the '80s. As for the inflation rate, it saw its strongest surges in 1973 and 1979 while it dropped rapidly in the years following the brutal recessions of 1981-82 and 1990-92. In addition to these macroeconomic fluctuations, sudden reversals in capital gains expectations also led to fluctuations in the cost of use. For example, if households anticipate that the recent price movements will continue, the expectations are such that they provoke speculative bubbles. The mechanism that produces them is now well known. An unexpected exogenous shock pushes the housing price upward significantly and households begin to expect that the movement will carry on at least for a certain time. This anticipation then reduces the cost of use, which further stimulates the housing demand and perpetuates the price increase that had been expected. Such a speculative movement is of relatively short duration since the buyers' ability to pay is not unlimited. Levin and Wright (1996) nevertheless show that it feeds price instability.

Lastly, although it does not appear explicitly in equation 1, the inflation rate can strongly influence the capital cost of use. In fact, changes in the inflation rate have an almost unitary repercussion on interest rates. This means that when the inflation rate rises by 1%, nominal interest rates also have a tendency to rise by one percentage point. Furthermore, a rise in the inflation rate should also raise the anticipated housing price appreciation rate by one percentage point. Under these two hypotheses, a rise of one percentage point in the anticipated inflation rate reduces the housing use cost by $\tau(1-\theta)$.[3] Inflation has no effect only if the owner invests no equity in the dwelling or if his or her interest income is not taxed.

2.1.2 Headship Rate and the Aggregate Housing Demand

Housing demand varies according to age, type of household (family as compared to non-family), number of persons per household as well as other characteristics.[4] The housing demand of a household belonging to demographic group i in time t can thus be written $d_{it}(X_t, P_t, U_t)$. Here, U_t represents the housing use cost, P_t is the capital cost of the dwelling while X_t represents an exogenous variables vector. These variables capture the effect of the economic conditions beyond the changes in the housing use cost. In a later chapter, we will specify the list of the relevant variables.

The transition to the aggregate demand for demographic group i is obtained by multiplying $d_{it}(X_t, P_t, U_t)$ by the number of households found in this group in time t. This number can be expressed as the product of N_{it}, the total population of the group, and the headship rate in this group, that we note as m_{it}. A household being by definition the persons occupying the same dwelling, the headship rate indicates the propensity of a population to form sub-groups sharing the same dwelling. As Skaburskis (1997) recently showed, the household headship rate varies according to age, type of household, income, gender, the presence of children and the price of the dwelling. The headship rate is therefore a function of the

same variables as those which determine a household's housing demand so that we can write $m_{it}(X_t, P_t, U_t)$. Consequently, the total housing demand for group i in time t can be written as:

$$D_{it} = N_{it} \times m_{it}(X_t, P_t, U_{it}) \times d_{it}(X_t, P_t, U_t)$$
$$= N_{it} \times h_{it}(X_t, P_t, U_t) \qquad (2)$$

where $h_{it}(X_t, P_t, U_t)$ is a convolution of the decision to form a household and of the housing demand by household. Conceptually, the difference between the two is that d_{it} is the housing demand per household of group i while h_{it} is the demand per individual in this same group. In order to circumvent certain problems raised by the endogeneity of the decision to form a household, it is more practical to refer to h_{it} rather than to d_{it} to speak of the individual demand.

The aggregate housing demand in time t, D_t, is simply the sum of the demand of n different demographic groups, or:

$$D_t = \sum_{i=1}^{n} D_{it} = \sum_{i=1}^{n} N_{it} h_{it}(X_t, P_t, U_t) = H_t(N_{it}, X_t, P_t, U_t) \qquad (3)$$

The aggregate demand function thus depends positively on the size of the different demographic groups N_{it} and negatively on the real price P_t and cost of use U_t. The sign of the partial effects of the exogenous variables depends, for its part, on the variables selected in vector X_t and will be clarified later.

2.2 Housing Supply

The housing supply is a simple function. The assumption is that new housing construction C_t depends on the housing price P_t and on a variables vector W_t affecting the supply. Among the variables entering into W_t is the price of the resources used in construction, i.e. the vacant land, materials and labour. If the price of these inputs rises, housing activity becomes less profitable so that construction activity decreases. Since the contractor must finance the units he or she builds in the short term, we also expect the short-term interest rates to have a negative impact on construction. Lastly, some indicators of the ease of disposing of housing on the market can be included in W_t. For example, DiPasquale and Wheaton (1994) used the mean time necessary for selling a new dwelling and showed that this variable had a negative impact on construction. One substitute could be the housing vacancy rate which has an anticipated positive effect on construction.

If the assumption is that the housing stock depreciates at a constant rate δ, the supply equation can be written as follows:

$$\Delta S_t = C_t(W_t, P_t) - \delta S_{t-1} \qquad (4)$$

Equation 4 can also be presented in the form:

$$S_t = C_t(W_t, P_t) + (1-\delta)S_{t-1} \qquad (4')$$

The important characteristic of such a supply equation is that it implies a very different reaction in the short term than in the long term. Housing starts represent a very small fraction of the housing stock. Consequently, the short-term supply, in a one-year outlook for example, is relatively inflexible. However, since the housing supply does not require the use of resources specific to the industry, elasticity of supply is very great in the long term. The only element likely to prevent the housing supply from being perfectly elastic over a long period is the cost of land. It is the spatial theory that determines what the long-term housing equilibrium price will be.

To illustrate how the spatial theory analyzes the long-term impacts on the price of land, assume that an increased housing demand forces the conversion of part of the farmland into urban land. The reduction in the cultivated area leads to a reduction in the supply of agricultural products and an increase in real food prices. This rise in food prices, increasing the profitability of agricultural production, will lead to keener competition for buying arable land, which will raise the price. To justify an urban vocation for lands whose agricultural profitability is greater, the real price of urban land must also rise, which increases the real housing price in the long-term. Demographic growth therefore creates an upward trend in the real housing price. Empirically,

however, this trend can be countered by an inverse effect. Indeed, there is an underlying growth in agricultural productivity. Because it reduces the real food prices, this productivity growth reduces the real land price.[5] This lowers the housing activity costs and promotes a greater spatial dispersion in cities.

2.3 Market Equilibrium

If we assume that the housing price is flexible enough to ensure stock equilibrium between supply and demand, we can write:

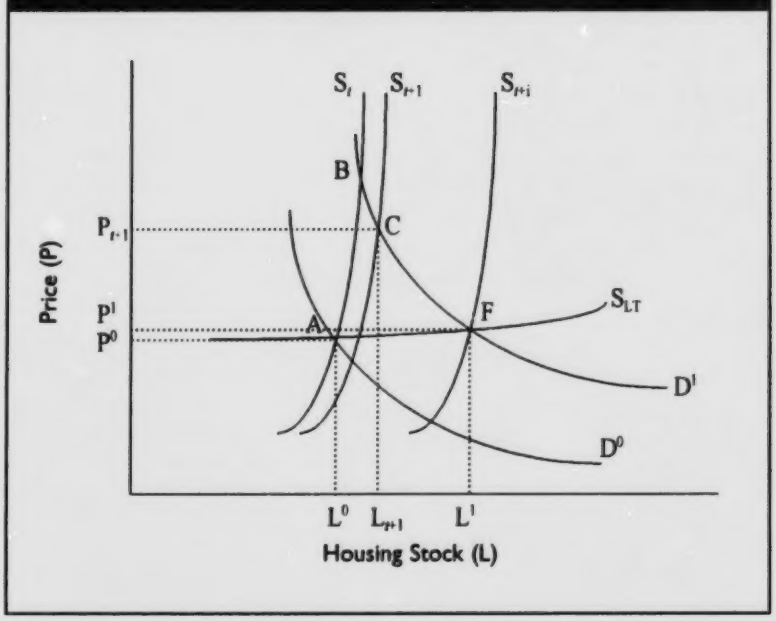
$$H_t(N_t, X_t, P_t, U_t) = C_t(W_t, P_t) + (1-\delta)S_{t-1} \qquad (5)$$

Recently, DiPasquale and Wheaton (1994) suggested that the housing price did not reach its equilibrium value instantaneously so that the stock equilibrium condition was not met in the short term. They empirically support this conclusion by showing that the lagged real housing price substantially improves the forecasts in a model for price and housing starts in the United States. We will attempt later to verify whether it proves appropriate to assume that the price adjustment is gradual.[6]

Equation 5 clarifies the variables that modify the real housing price. This equation shows that on impact, a stronger growth in the size of one of the demographic groups tends to raise the real price. However, the effect on the price tends to wane as soon as it reaches the date t+1. In fact, the price increase in time t accelerates housing activity such that the housing capital stock at time t+1 is higher. If the speed at which the housing capital stock adjusts is rapid, the price quickly returns to its long-term equilibrium value. Conversely, if the stock adjusts slowly, the price will take longer to return to its long-term value. Appendix 1 shows the algebraic adjustment in more detail.

Figure 2 shows, in a graphic presentation, the dynamic adjustment resulting from a permanent increase in the housing demand from D^0 to D^1. Initially, the market is in long-term equilibrium. At the time of the increase in demand, the price rises along the short-term supply curve S_t, moving from the initial equilibrium A to the new temporary equilibrium B. Since at this price level housing activity is very profitable, this accelerates the rate of housing starts. Hence, at date t+1, the housing supply is displaced from S_t to S_{t+1} so that the market equilibrium, one period after the rise in demand, is situated at point C. Since the price is still higher than that on the long-term supply curve, the rate of activity remains steady, which again displaces the supply to the right. The final equilibrium is located at point F when the demand crosses the short-term and long-term supply at the same point. In such a situation, the housing stock remains stable because housing activity is no longer generating abnormally high returns.[7]

Figure 2
Real Housing Price Determination



What characterizes the final equilibrium as compared to the initial situation is the weak price reaction. This is explained by the fact that, in the figure, the long-term supply curve has a very slight positive slope. This reflects the presumed effect of a persistent weak growth in the real price of land. Such a result must be qualified. If the rise in demand is located in a region where undeveloped land is rare, the long-term supply curve will have a more pronounced slope. If, on the other hand, land is abundant, the long-term supply curve will be virtually horizontal. The increase in demand would then have no lasting effect on the housing price.

Although simple, this model contains all of the elements necessary for analyzing the evolution of the real housing price in Canada. It will be used as a guide for the next chapter.

3. HISTORICAL EVOLUTION OF REAL HOUSING PRICES IN CANADA

3.1 Data Available on Housing Price

There are several different sources for Canadian data on housing price. The most extensive series is the average sales price as compiled by the Canadian Real Estate Association. Statistics Canada publishes three indices related to housing price, namely, the New Housing Price Index, the Residential Building Construction Price Index[8] and the housing cost components in the Consumer Price Index. The third source of information is from Canada Mortgage and Housing Corporation, which, from the early '50s until 1985, published the average sales price of housing financed under the *National Housing Act*. This price will be designated by the NHA. The Royal LePage index provides an estimate for the sales price of bungalows. Lastly, for the purposes of the study, we have developed another housing price measurement by dividing the total housing value in the Statistics Canada National Balance Sheet Accounts by the total number of dwellings in Canada. The following sub-sections explain the advantages and drawbacks of these different price measurements.

3.1.1 Multiple Listing Service (MLS) Price

The MLS price is based on a record of the real estate transactions conducted in the nation's different cities. The Canadian Real Estate Association (CREA) has been collecting this data since 1956. The record contains information on the price and number of transactions. Approximately 90% of the properties sold are residences. In addition to the data on the overall transactions, CREA has been publishing separate residential data since 1975. The first is called the Total MLS while the second is called the residential MLS. However, because of the preponderance of residential transactions, the behaviour of the residential MLS does not differ significantly from the Total MLS.

The longest continuous historical series of housing prices that can be obtained is the Total MLS price for Canada. This series has been available on an uninterrupted basis since 1956. We can also obtain data dating back to 1960 for the Atlantic Provinces, as well as for the six other provinces, namely Quebec, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia. The provincial data breakdown for the Atlantic Provinces has only been available since 1971. The residential MLS price became available on a provincial basis beginning in 1975.

The MLS data are the only ones that offer such long historical continuity while also being available on a regional basis. On the other hand, they present two main drawbacks. First of all, they do not allow any differentiation between the unit price variations and those stemming from the improvement of housing quality or size. Since the progressive improvement of real income allows Canadian households to occupy better housing, the average quality of the residential housing stock tends to improve. The evolution of the MLS price is therefore going to overestimate the average increase in the real housing price. Furthermore, the transactions deal just as much with single-unit as with multiple-unit residential buildings. The average transaction price therefore overestimates the average price per dwelling unit because of the transactions on the multiple-unit residential buildings.

3.1.2 New Housing Price Index

Statistics Canada has published a New Housing Price Index since 1971. This index is constructed by calculating, on a monthly basis, the rate of change in the sales price of the same model of house newly built in the same neighbourhood. The average rate of change is obtained by taking the average of the rates of change seen in different house models. When a model is no longer sold, it is replaced in the index by an equivalent model.

Statistics Canada has published the results of two different New Housing Price Index surveys. The first series was published for the period from 1971 to 1990, while the current active series begins in 1981. From 1971 to 1974, the survey covered only six metropolitan municipalities, namely Montreal, Ottawa-Hull, Toronto, Winnipeg, Calgary and Edmonton. In 1975, the survey was expanded to cover the metropolitan regions of Halifax, St. Catharines/Niagara, Kitchener, London, Regina and Saskatoon. Since 1976, the cities of St. John's, St. John, Moncton, Québec, Hamilton, Windsor, Sudbury, Thunder Bay, Vancouver and Victoria have been included. Currently, there are 20 metropolitan municipalities covered by this survey. In addition, the New Housing Price Index is available in three forms, namely, separate data on the building and the land, or the total of the two.

The main advantage of these data compared to the MLS data is that the changes in quality do not influence the price variations. A second, less important advantage is that it offers the possibility of making a distinction between the land and the structures. Lastly, these indices are available separately for approximately twenty metropolitan municipalities. On the other hand, there are two principal drawbacks in these indices. The first is that they cover only new housing. It is therefore dangerous to extrapolate the movements to the existing residential housing stock as a whole. The second drawback is common to any index number, which is being arbitrarily standardized in comparison with a base year. The index therefore does not provide information on the housing price level, but only on its variations.

Two other pieces of information associated with the housing price are published by Statistics Canada. The Residential Building Construction Price Index has been available quarterly since 1971. This index is a deflator used to estimate the real value of housing activity in national income accounting. This index is not a direct measurement of the housing sales price but rather an indicator of the construction input costs. Its movements are expected to be strongly related to new housing prices. On the one hand, because changes in housing prices are often reflected in the input prices and, conversely, because the contractors will try to pass on the changes in construction costs to homebuyers.[9] Lastly, different housing cost measurements enter into the Consumer Price Index but their relationship to the housing price is fairly vague. In fact, the housing component of the CPI measures the housing services cost, which, as indicated in the previous chapter, is related to the price of the dwelling by its cost of use. Since the latter can fluctuate rapidly, the cost of providing services can sometimes evolve in the opposite direction from the housing price. For example, a drop in interest rates reduces the cost of use which lowers the housing services cost. Since the drop in costs encourages households to consume more housing services, this increases the housing demand and pushes their price upwards. There is then simultaneously a decline in the housing cost index in the CPI and a rise in the housing price.

3.1.3 Price of Housing Financed Under the *National Housing Act*

From the early '50s until 1985, Canada Mortgage and Housing Corporation published the price of new homes financed under the *National Housing Act*. Compared to the New Housing Price Index, CMHC price data contain no adjustment for quality. There is, however, information on habitable floor space. On the other hand, these data are not merely indices because they indicate the average price level. Their main defect is that the series ceased more than ten years ago.

3.1.4 National Balance Sheet Accounts Data

Since 1960, the Statistics Canada National Accounts Division has been publishing an annual estimate for the national balance sheet accounts and the major Canadian economic sectors. The balance sheet data are completely integrated into the national revenues and expenditures accounts. To obtain the value of the assets and liabilities, Statistics Canada estimates the unit market value of the assets whose quantity is established by

using a perpetual stock methodology.
In order to estimate the average value of new and resale housing, the estimated value of the sum of the residential buildings is divided by the number of units. The main advantage of this method is that it provides a direct estimate of the average price of the housing stock, contrary to the other methods that indicate either the average new housing price or only the average price of new or resale buildings that exchanged hands during the year. Another advantage of this measurement is that it provides data on a continuous basis since 1960. The drawbacks are that no quality adjustment is made, no regional breakdown is available and the market value is roughly estimated.

3.1.5 Comparisons of these Data With a Constant Quality Index

To ideally analyze the real housing price, it would be necessary to have housing price data that are adjusted to eliminate the effect of the variations in housing quality and size. One method that initially allows for controlling these effects is that of repeat sales. To build such an index, only units that have been sold more than once are used. The main limitation of this method is that it provides a very low sampling rate since only a very small portion of the housing stock is sold several times. Furthermore, it is likely that the homes subject to more frequent sale are not entirely representative of housing as a whole.

Recently, Goy and Steele (1994) were able to use an extensive database on the city of Kitchener to develop some constant quality price indices. Their building method is based on the estimate of hedonistic regressions on 9,856 first-time starter-home transactions carried out from 1988 to 1990. Such a method makes it possible to calculate the price variations of the characteristics and then to reconstruct the price changes for a house with certain specific characteristics based, in this case, on quasi Fisher, quasi Laspeyres and quasi Paasche[10] chain indices.

However, the principal interest of this study for this topic is that, after having developed a constant quality index, the authors compare it with the data usually used to measure price variations. They were thus able to evaluate the relative performance of the Multiple Listing Service (MLS) price, the average price of homes insured under the *National Housing Act* (NHA), the Royal LePage index and the New Housing Price Index (NHPI). This allows them to conclude that the MLS price is astonishingly similar to the quasi-Fisher index. The average NHA price itself shows a delayed peak even if the level is very similar to that of the MLS. As for the rate of the NHPI increase, it is substantially lower than the rate of increase suggested by the quasi-Fisher index applied to new homes, as well as to that of the constant quality homes for first-time buyers.

These observations are a bit surprising. In actual fact, of these three price measurements, only the NHPI makes an adjustment for quality. One would therefore expect that the two other series overestimate the true price increases. The NHPI itself should provide an unbiased estimate of the price increase in constant quality homes. Yet, we see instead that the NHPI underestimates the true constant quality price increases. Goy and Steele provide an explanation for this NHPI bias. The new housing models marketed would be more in demand because they suit the tastes of the times. They would thus be initially sold at a premium. The price would decline however as the end of this model's production approached. Since the NHPI measures the price change in the same model, it captures this real price decline resulting from the product's cycle and interprets it as a price decrease stemming from market conditions.

This comparison therefore suggests that the MLS data offer good quality for estimating price variations over a short period. Since they are also those with the greatest availability both historically and regionally, they thus constitute a first choice for analyzing the housing price in Canada. However, the conclusions on the long-term evolution in the housing price will have to be weighted by judging the possible impact of the qualitative improvement in housing over the course of the period under study, and of the possible NHPI bias.

3.2 Historical Evolution of Real Housing Prices in Canada

3.2.1 Price Level Evolution

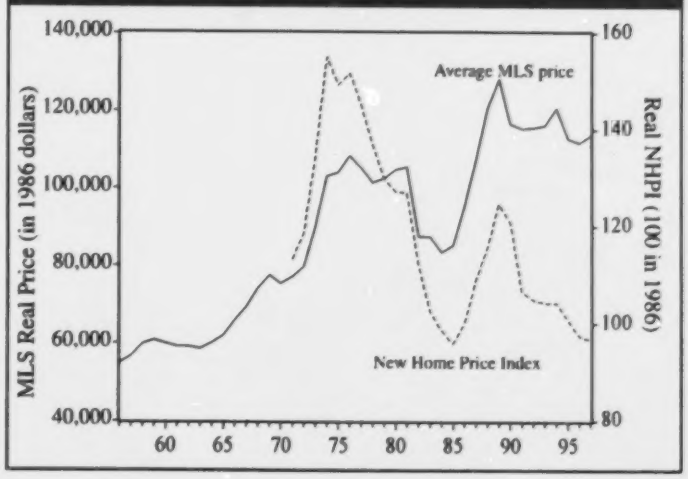
The evolution of real housing prices in Canada revolves around two aspects that have separate causes, namely, the long-term trend and the short-term variability. Attention will focus firstly on the trend by studying different price level measurements. So as to eliminate the effect of inflation, all of the price series have been converted into real 1986 dollars by dividing them by the Consumer Price Index that has a value of 100 in 1986. As for the indexed series, they are standardized to have a value of 100 in 1986. Because of its lengthy availability, the MLS series will be used as a reference point for the price measurements.

Figure 3 shows the average MLS price on the left scale, while the New Home Price Index is measured on the right scale. These two series show that the real housing price is subject to strong annual fluctuations. Hence, between 1972 and 1974 and again between 1985 and 1989, the real housing price rose by approximately 25%. On the other hand, the real price posted a decline between 1981 and 1985. The broad trend also shows a decline throughout the '90s. Furthermore, the two series do not identify exactly the same peaks. In fact, between 1975 and 1976 the real MLS price continued to advance by nearly 10% while the NHPI declined.

The most striking aspect of this comparison is that, even if both measurements capture similar short-term movements, they provide diametrically opposed information on the long-term price trend. The average real MLS sales price displays a definite upward trend while the real NHPI tends to decrease. Hence, between 1971 and 1997, the real MLS price went from $77,116 to $113,593, or an increase of 47% in 25 years compatible with an annual compound rate of 1.5%. For its part, the real NHPI went from an index value of 113.3 in 1971 to 96.6 in 1997, or an average annual decrease of 0.6% for 25 years. The average annual growth rate of the NHPI is therefore 2.1% weaker than that of the real MLS price.

A previous section indicated two reasons why these price measurements may poorly monitor the evolution of the real price of constant quality housing. We know that the MLS price makes no adjustment for quality. We suspect the NHPI, on the other hand, of systematically underestimating the true rise in the cost of new housing. Initially, any combination of these two explanations compatible with an annual absolute difference of 2.1% would be equally valid. We can, for example, suggest that the NHPI actually does adequately measure the real price of constant quality housing. The data would then indicate that the real housing price has indeed decreased an average of 0.6% per year. This would equally imply that the average quality of the units recorded in the MLS transaction records rose by 2.1% per year. We can, on the other hand, believe instead that the real price was stable. This would imply that the NHPI underestimates the price increase by 0.6% per year and that the average annual increase in housing quality grew by only 1.5%

Figure 3:
The MLS Price and the NHPI



per year. In order to put forward a more plausible interpretation, we focus our attention on some other price series.

Figure 4: The NHA Price and the NBSA Price

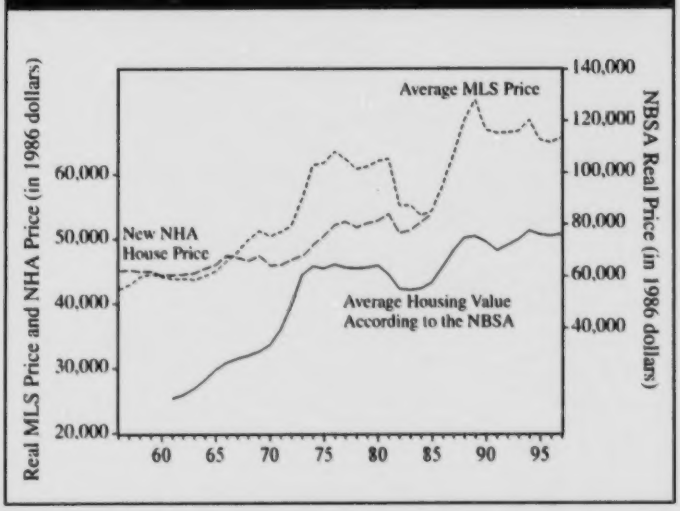
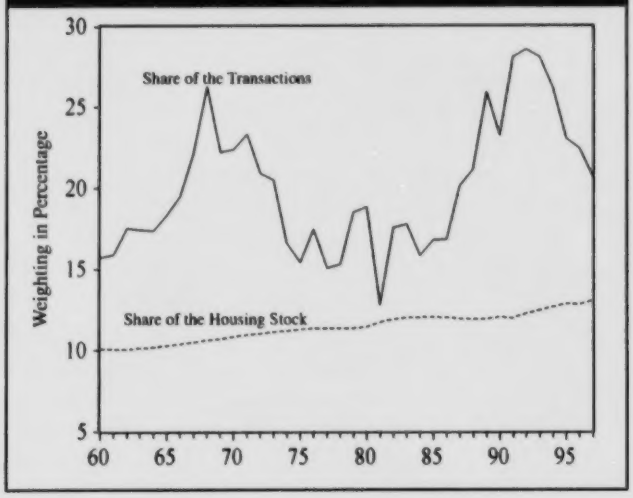


Figure 4compares the real MLS price with that of new homes insured under the *National Housing Act* (NHA) and the average housing value according to the National Balance Sheet Accounts (NBSA). The NHA price has a value very similar to that of the MLS transactions until the middle of the '60s. Since that date however, the MLS price has experienced much more pronounced fluctuations than the NHA price. The behaviour divergence is particularly acute between 1972 and 1976 when the NHA price advanced by only 20.3% as compared with a gain of 35.9% for the MLS price. However, there are some valid reasons for believing that the NHA price underestimated the true price rise during this period. Laycock (1978)[11] reminds us that one of the NHA loan eligibility criteria is the price of the unit. But, the maximum value of units eligible for NHA loans was not adjusted quickly enough to the unexpected increase in the housing price in the early '70s. The consequence of this was to reduce the range of housing that was eligible for NHA loans, thereby introducing a serious quality bias into NHA prices at that time.

Figure 5: British Columbia's Weighting in the MLS Price

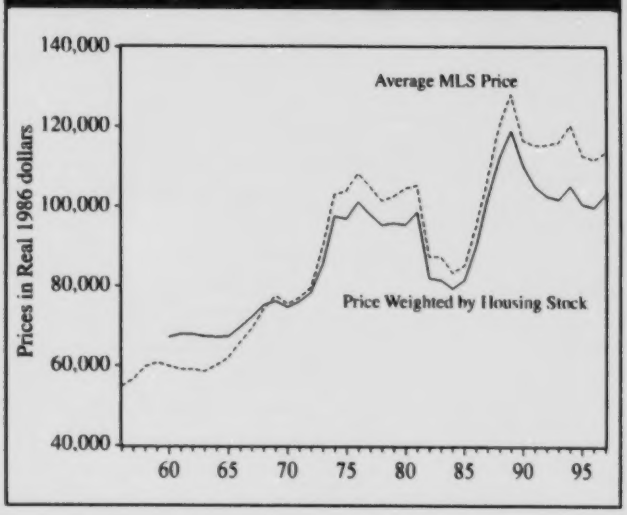


As for the series of prices estimated according to the National Balance Sheet Accounts (NBSA), its average level is at only 45% of that of the MLS price. However, even though this series is a bit smoother, its annual movements nevertheless quite faithfully copy those of the MLS price series. Furthermore, between 1971 and 1997 the active NBSA price went from $36,035 to $50,690, an increase of 40.7%. Such an increase is similar to the one measured by the real MLS price.

The MLS weights the different regions of the country according to the number of transactions. Although these refer just as much to resale homes as new homes, all the new homes are the subject of a transaction while only a small portion of the resale homes is transacted every year. Hence, the weighting attributed to the different regions in calculating the national MLS price reflects more the proportion of housing starts than that of the housing stock. The result of this is that the provinces of British Columbia, Ontario and Alberta, which are experiencing higher demographic

growth than the national average, receive disproportionate weighting in the national MLS price. Thus, between 1960 and 1997, Ontario's weight in the average MLS price was 56% while this province has only 42% of the number of units.[12] Similarly, British Columbia receives an average weighting of 20% while its average share of the housing stock is only 11%. Conversely, the Atlantic Provinces and Quebec are greatly under-weighted, receiving a share of only 12% of the transactions while they account for nearly 35% of the nation's housing. Furthermore, since the cyclical fluctuations in real estate transactions are not perfectly synchronized, the different regions' shares in the number of transactions experience significant annual variations. If the prices differ from one region to another, these weighting changes cause price variations that do not match the value of the housing stock.

Figure 6
Average MLS Price and Price Weighted by Housing Stocks



To illustrate the regional weighting disequilibrium as well as their significant annual variability in the MLS price calculation, Figure 5 compares British Columbia's share of the transactions and the housing stock. Since the prices in this region are higher than the national average, this province's heavy weighting tends to unduly inflate the national price. Part of the increase seen at the national level at the end of the '80s therefore results solely from the exaggerated increase in British Columbia's weighting.

These drawbacks in the Canadian MLS price can be corrected by weighting the provincial MLS sales prices by each province's share of the housing stock. To obtain a real value, this price was further divided by the CPI to obtain the real weighted MLS price. Figure 6 shows weaker underlying growth than that of the average MLS price between 1960 and 1997, or an average annual growth of only 1.15% as compared with 1.73% for the average MLS price.

These four series constitute the only direct measurements of the housing price. However, the underlying behaviour of the price can be inferred by studying the Construction Costs Index in real terms (CCI). The Residential Building Construction Price Index is constructed in the same manner as the other deflators in the gross domestic expenditures. Since these deflators are not known to be biased, it is probable that the CCI adequately measures the building cost of a constant quality dwelling. Furthermore, only a change in the contractors' profit margin can cause the change in the CCI to differ from that of the NHPI. We know that the profits are very sensitive to economic fluctuations. Consequently, we can expect the cyclical sensitivity of the NHPI to be higher than that of the CCI. However, it is difficult for the movements underlying both series to evolve very differently because the profit share tends to remain constant in the long term. This is reinforced by the fact that a considerable erosion of the margin is necessary for the sale price to drop significantly as compared to the building costs.[13]

Figure 7 compares the NHPI and CCI evolution in real terms. The fluctuations of both real series follow very similar short-term movements. However, the CCI does not show the downward trend of the NHPI, having gone from 104.5 in 1971 to 102.3 in 1997, or an annual average decrease of less than 0.1%. If we accept the preceding argument, we can conclude that the most plausible hypothesis is that the price of

constant quality housing was situated at nearly the same level in 1997 as in 1971.

To verify whether this is really an underlying discrepancy and not a discrepancy linked to less favourable conjunctural circumstances in 1997 than in 1971, estimations were made using a linear regression, whether a trend explains the movement divergence between the two series. Over the period from 1971 to 1997, it was found that the relative NHPI decrease results from a trend.[14] This estimate confirms that the underlying rate of increase of the NHPI is half a percentage point less than that of the CCI, that the NHPI therefore has an average bias of -0.5% per year. As a consequence, this also implies that the MLS price and the NBSA price capture an average improvement in housing quality of approximately 1.5% per year. This improvement, which could be the result of the gradual increase in real income, will be analyzed in a later chapter.

Figure 7:
The CCI as Compared to the NHPI

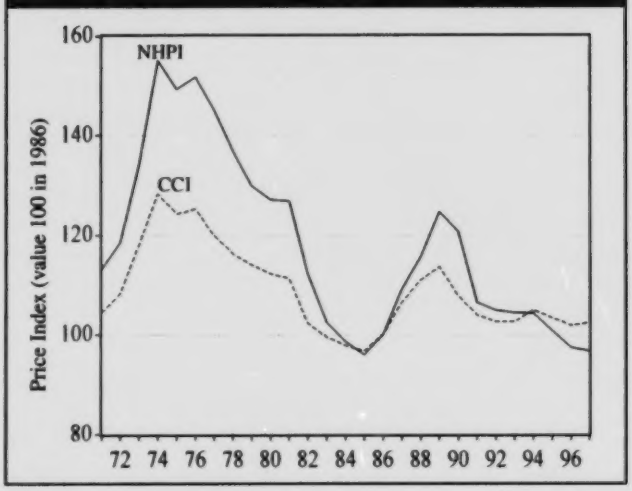


Table 1:
Price Growth Rate Correlation (1972-1997)

	MLS	NHPI	NBSA	CCI	NHA (72-85)
MLS	1.00	0.82	0.73	0.91	0.78
NHPI	0.82	1.00	0.75	0.93	0.59
NBSA	0.73	0.75	1.00	0.83	0.41
CCI	0.91	0.93	0.83	1.00	0.60
NHA (72-85)	0.78	0.59	0.41	0.60	1.00

3.2.2 Rate of Change in Real Housing Prices

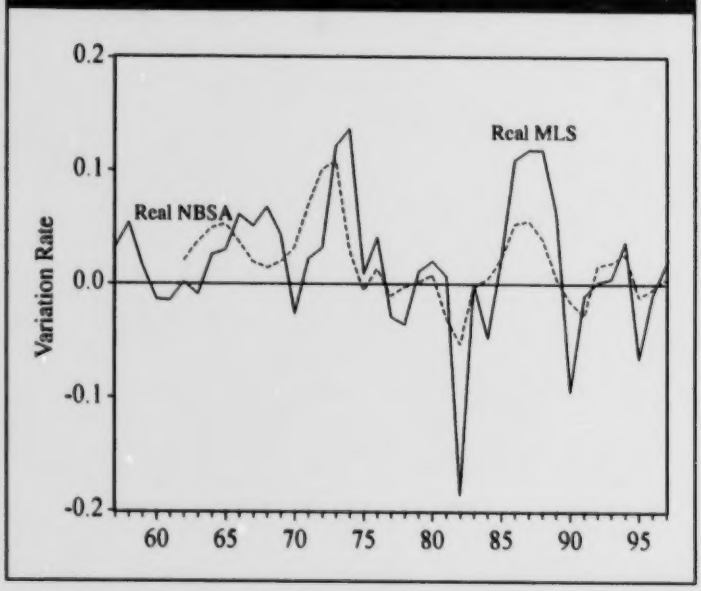
Even if the trends differ between the indices, their annual movements are, generally speaking, very similar. Table 1 shows the simple correlations between the rate of growth of the four housing price measurements, as well as with the CCI. These correlations are calculated for the 1972-1997 period, except for the NHA price, which is only available until 1985. These correlations are very strong between the MLS, NHPI and CCI prices and even reach 0.93 between the latter two. On the other hand, the NHA price is less strongly correlated than the other measurements. This is due to the fact that the NHA does not capture the strong price increase between 1972 and 1975.[15]

Table 2:
Price Growth Rate Volatility and Autocorrelation (1972-1997)

	MLS	NHPI	NBSA	CCI
Average	0.015	-0.006	0.0131	-0.001
Standard Deviation	0.072	0.067	0.036	0.041
Maximum	0.136	0.145	0.109	0.087
Minimum	-0.186	-0.126	-0.053	-0.085
Autocorrelation	0.355	0.498	0.694	0.473

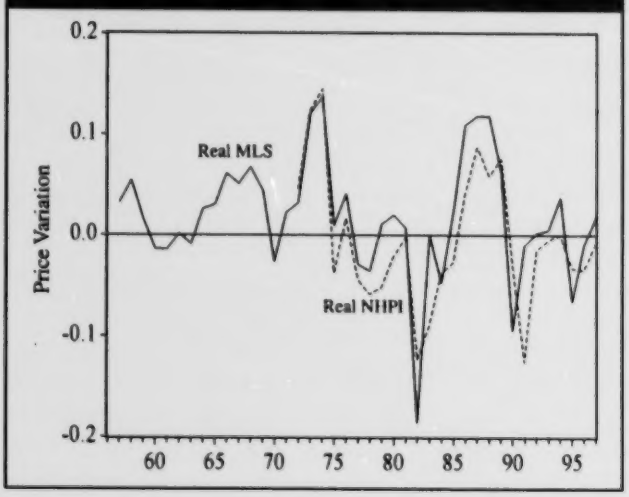
Table 2 compares the volatility of the series. There is a fairly strong difference since the NBSA growth rate has a dispersion around its average similar to that of the CCI growth rate but twice as weak as that of the MLS and NHPI growth rates. Irrespective of the measurement selected however, what stands out is that there is great volatility in the housing price. Since demographic movements are a very slow phenomenon, it is obvious that the origin of these short-term price fluctuations is not demographic. It is the NBSA growth rate which shows the strongest autocorrelation of the first order, since it reaches 0.7 versus approximately 0.5 for NHPI and CCI and only 0.36 for MLS.

Figure 8:
MLS and NBSA Variation Rates



Figures 8 and 9 show the comparative evolution of the growth rate of the MLS, NBSA and NHPI measurements, the NHA price being excluded because of its lack of reliability and limited availability. There is an extremely coherent picture of the housing price movements in Canada since the early '70s. The prices made strong progress in real terms during two episodes, namely, those from 1972-75 and from 1985-88. On the other hand, the prices plunged dramatically in 1982 and a little less in 1990-1991. In the next section, we will review certain factors possibly having exerted an effect on the housing price, i.e. demographics, the economic conditions, the housing use cost and housing starts.

Figure 9:
MLS and NHPI Variation Rates



3.3 Evolution of the Factors Influencing Prices

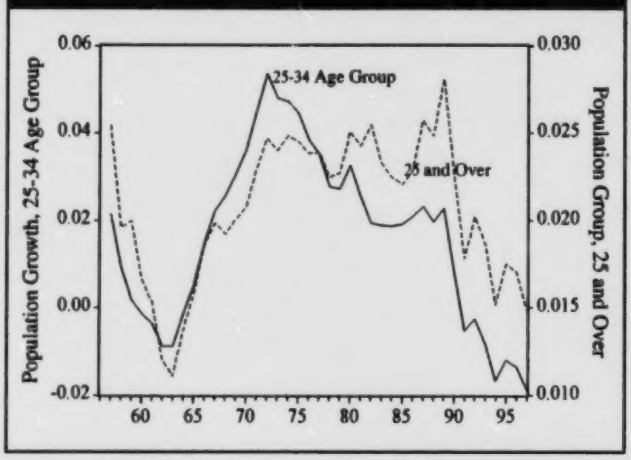
3.3.1 Demographic Changes

It is not clear how to measure the demographic pressures on the housing price. If we accept the Foot and Stoffman contention, it is the growth in the contingents of young adults that constitutes the best measurement. This perception is founded on the hypothesis that housing demand reaches a peak at a young age. It is in fact possible that, since the housing demand depends on the household's permanent income, it is, instead constant with age.

In such a case, it would be the growth of the adult population that would be important. To consider

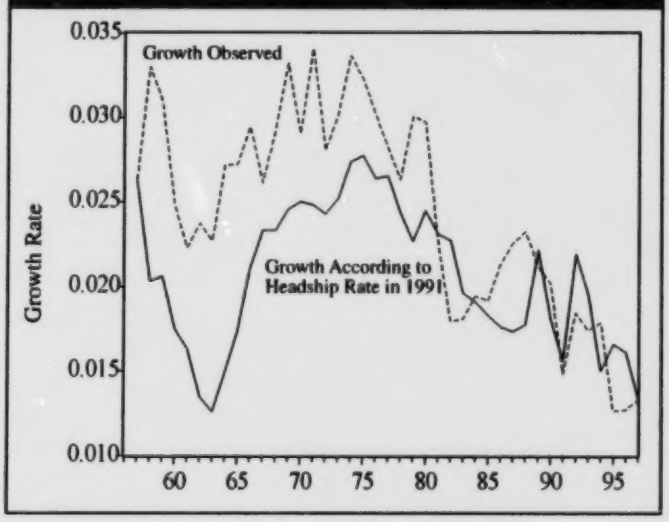
these two possibilities, Figure 10 shows the evolution of two groups, the population aged 25-34 and that aged 25 and over.[16]

Figure 10:
Population Growth



We observe that the demographic pressures differ a great deal according to the two measurements. Hence, after being negative in the early '60s, the 25-34 population growth accelerated rapidly to reach a growth rate of more than 5% in 1972. It subsequently slowed until the beginning of the '80s to stabilize at 2% until about 1989. It then experienced another decline in the early '90s, this time so rapid that the population in this age group decreased by nearly 2% per year thereafter. According to this measurement, it is in the early '70s that the upward demographic pressure on the prices would have been strongest and the downward pressures would begin to show in the '90s. On the other hand, the growth of the population aged 25 and over, measured on the right-hand scale, experienced a less erratic and lagging evolution than the 25-34 age group. After declining in the early '60s, the population's growth rate accelerated slightly until 1972. It then remained fairly stable at approximately 2.5% per year until 1990. Since then, the growth rate has started to decline again and was at 1.5% in 1997.

Figure 11:
Growth in the Number of Households



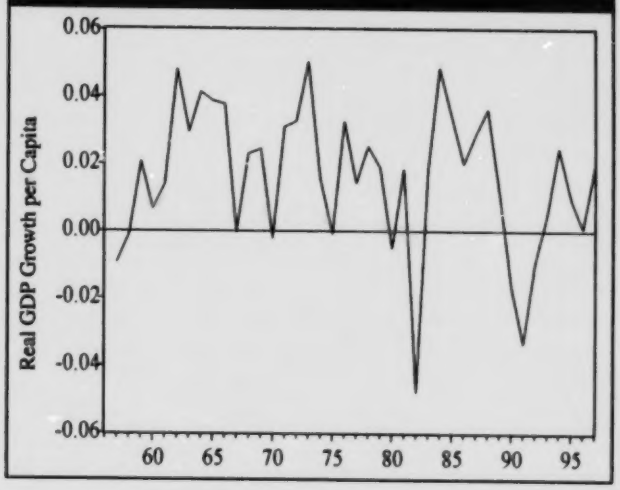
The two preceding measurements are based on population. Yet the unit requesting housing is the household. If household size varies in time, population growth will provide a skewed picture of the growth in the number of dwelling units required to house the population. This is the reason why several demand forecast models instead target the growth in the number of households to measure the demographic impact.[17]

Figure 11 presents the growth observed in the number of households. However, even if household growth is conceptually superior, as explained in section 2.1.2, the headship rate reacts endogenously to the real price of housing services. The result of this is that the historical growth in the number of households constitutes a biased measurement of demographic pressures.

One way of getting around this difficulty consists of calculating the growth in the number of households that would have been observed if the headship rate had remained constant. Using data from a census, the headship rate for each age group is established, which is then multiplied by the matching population cohorts. In this manner,

we obtain the number of households that would have been observed if the headship rate had been that of the selected census year. DiPasquale and Wheaton (1994) proceed in this way to obtain what they call *"the age-expected household formation"*. Since the year chosen for establishing the headship rate is arbitrary, this study chose 1991 and used the headship rate for each 5-year age group. Figure 11 also contains the growth in the number of households that would have been observed if the headship rate were still that of 1991.

Figure 12:
GDP Growth Per Adult



Because of the underlying decline in the size of households, we see that until the late '70s, the growth observed surpasses that calculated at a constant headship rate. We also notice that household growth slowed significantly, changing from more than 3% in the early '70s to a little more than 1% recently. The deceleration was especially rapid at the beginning of the '80s. By comparison, the growth with a constant headship rate displays smoother behaviour since its decline is more gradual. We also see that demographic growth was relatively weak in the early '60s but accelerated strongly at the beginning of the '70s. The growth schematic for the number of households at a constant headship rate is in fact similar to that of the population aged 25 and over, which confirms the 0.73 correlation between the two variables.

3.3.2 Macroeconomic Conditions

The real Gross Domestic Product (GDP) constitutes the least controversial measurement of the state of the economy. By definition, the total GDP is the product of the population and the gross domestic product per capita. Since population growth has been already measured, we will use the GDP growth divided by the adult population as a conjunctural measurement in order to avoid counting the population effect twice. Figure 12 confirms the importance of the two major recessions, that of 1981-82 and that of 1990-92. The 1962-66 and 1984-88 periods stand out as being those that experienced the greatest real income growth per person.

3.3.3 Housing Use Cost

As shown in 2.1.1, the cost of use depends on four factors, namely, the expected rate of appreciation in housing value, the nominal interest rate, the marginal investment income tax rate and the ratio of housing indebtedness. The first two variables are contingent upon individual circumstances and the individual changes are much more important than the temporal fluctuations that could be constructed at the aggregate level. Since these are not the variables that have changed the housing use cost the most over time, attention will be focused solely on the first two variables.

It is extremely difficult to measure the anticipated housing appreciation rate because it requires specifying how households formulate their expectations. If we assume they are formulated rationally, we need to have a complete model of the housing market that enables us to find the desired future price, conditional on the model's forecasts. Under a hypothesis of adjustable expectations, the anticipated growth depends on the recently observed price growth rates. Conversely, the speculative bubbles are often explained by the fact that households extrapolate the recent price movements.[18]

In the face of this range of choices, a simple formulation will be selected by assuming that the

real housing price expectations are not sensitive to the inflation rate. This implies that the anticipations for housing price variations react in a one-to-one ratio to the changes in the inflation rate. Consequently, the changes in the expectations for housing price growth will be directly related to variations in the CPI growth rate. We will use the interest rate on the 5-year mortgages. The cost of use was calculated on the assumption that the operating costs represent 6% of the value of the dwelling, that the marginal investment income tax rate is 50% and that the value of the mortgage is half the value of the dwelling. The 6% attributed to operating costs was established from data contained in the Statistics Canada publication Family Expenditure in Canada 1996, Cat. 62-555-XPB. The ratio was obtained by dividing the average expenses, excluding mortgage interest, by the average housing value in 1996 according to MLS data. It should be stressed that a change in one of these hypotheses affects the cost of use but insignificantly alters the changes it has undergone over time.

Figure 13:
Housing Use Cost

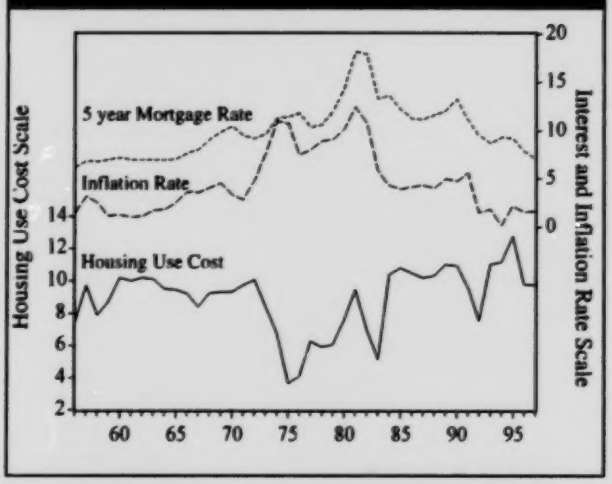


Figure 14:
Housing Stock Variation

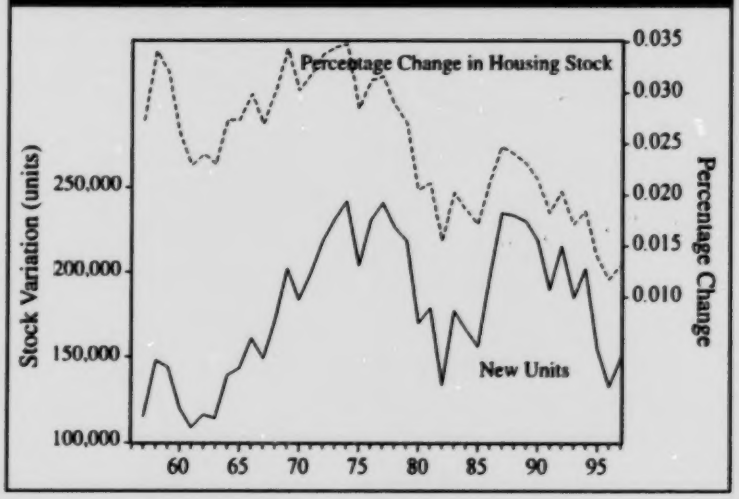


Figure 13 shows the evolution of the cost of use and the two macroeconomic variables. The inflation rate was low until the early '70s. It accelerated dramatically between 1971 and 1974 to remain at a high level until 1981 before dropping rapidly between 1982 and 1984. Thereafter, inflation remained stable until 1991 when it again declined and stabilized at approximately 2%. The interest rate evolved on a parallel except that it grew less than the inflation rate in the mid-'70s. Consequently, the housing use cost declined at the time when Canada was experiencing the inflationary trend of the '70s.

3.3.4 Housing Activity

A last factor likely to act on prices is the housing supply. Ideally, it would be desirable to have data capable of measuring some exogenous changes in building costs. Unfortunately, the research did not indicate any.[19] The evolution in the quantity of new housing supplied can be directly studied. Different sources can be used to measure construction volume. For reasons of historical continuity, the housing stock evolution published in the Statistics Canada CANSIM database, Matrix 4079 were selected.

Figure 14 shows the change in the number of housing units. The number of new units is

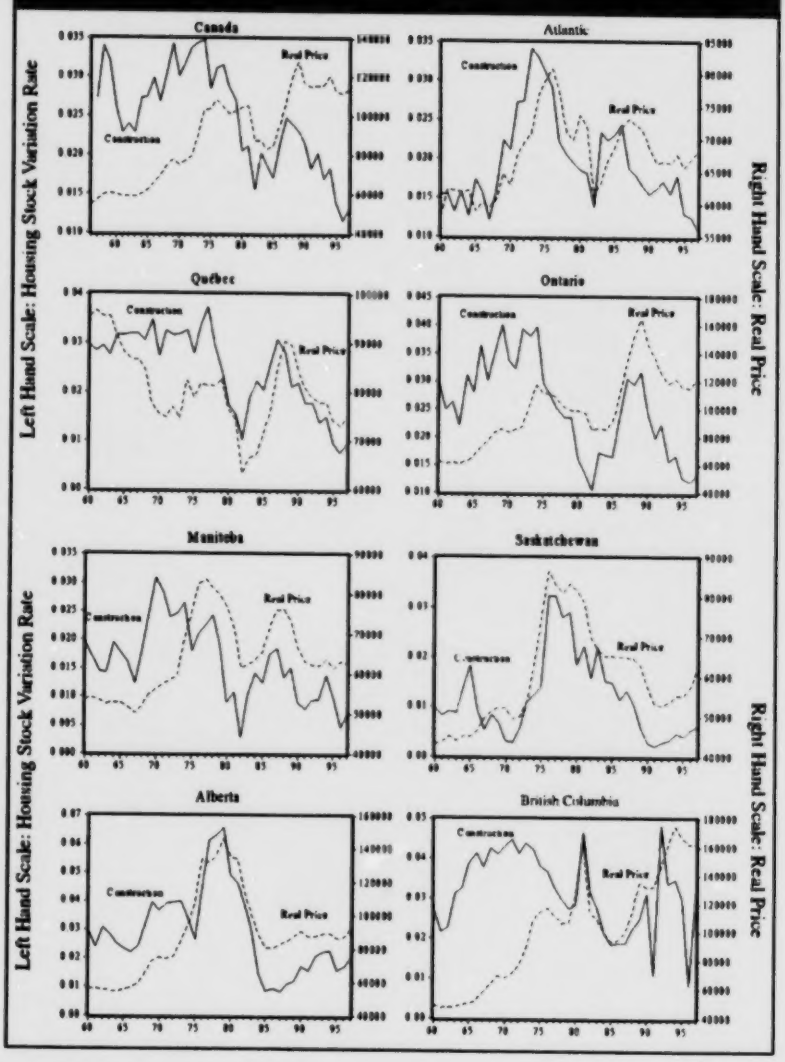
indicated by the lower curve, measured on the left-hand scale, while the percentage change is measured on the right-hand scale. The fastest growth rate was observed in the mid-'70s. Residential housing activity declined by half in the early '80s, at the time of the 1981-82 recession and record interest rates. After that, building resumed vigorously and the number of new units surpassed 230,000 in 1987 and 1988, activity levels similar to those observed in the mid-'70s. As a percentage, however, the rate of change reached only 2.5%, or one percentage point lower than the 3.5% growth observed in 1973.

It is interesting to compare the evolution of housing activity with that of the prices and the number of households. Indeed, the theory presented in chapter 2 suggests that construction reacts to the real housing price, which is influenced by the rate of household formation. By comparing the housing stock variation presented in Figure 14 and that of the number of households provided in Figure 11, we observe a very great similarity. However, this is difficult to interpret since the number of households is measured by the number of dwellings occupied. The difference between the stock and the number of households is therefore, by definition, attributable only to the change in vacant housing units. On the other hand, the comparison of the stock variation with that of the number of households at a constant headship rate is, itself, very important. It reveals that the housing activity trend faithfully follows that of the formation of new households.

This is compatible with very great long-term housing supply elasticity.

The price comparison shows that construction volume is subject to short-term variations similar to those of the prices. In fact, if we disregard the growing trend in prices and the declining trend in new housing, we can identify the same approximate episodes in both series: valley in the early '60s, peak in 73-75, valley in 82-85, peak at the end of the '80s and valley in 95. Such a positive correlation strongly suggests that, in the short term, price and construction movements are

Figure 15:
Construction and Price: Canada and Provinces



above all dictated by changes in the housing demand. The supply shocks, if they had any effect, played only a secondary role.

3.4 Regional Housing Price Evolution

The importance of local conditions in determining the housing price is major. The national conditions can mask large regional price and building variations. To see whether the consistencies observed at the Canadian level can also be found at a more broken-down level, we studied how the real price and the construction of new housing units evolved in the Atlantic Provinces and in Quebec, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia. The prices are those of the Multiple Listing Service while the housing stock data come from CANSIM.

Figure 15 shows the comparative evolution of these series. In all of the provinces there is a positive short-term correlation between the construction of new housing units and the real housing price. This consistency appears in spite of the fact that the regional cycles were very different. Hence, all of the Eastern and Central provinces experienced a sharp decline in price and construction during the 1981-82 recession. This contraction, although also observable in the other provinces, was less pronounced there. The first oil shock generated strong residential construction activity in Saskatchewan, while the trend was especially strong in Alberta at the end of the '70s. In both cases, the real price rose parallel to the construction booms. The Atlantic Provinces, Quebec and Manitoba experienced their activity peak in 1973 and subsequently showed a definite downward trend in construction. We also see that Quebec shows a more pronounced downward price trend than in the other provinces, which is explained above all by the very high transaction prices at the beginning of the '60s.[20]

Ontario and British Columbia stand out from the other provinces for the high price in the '90s. Although the housing price has declined in Ontario after peaking in 1989, it continued to grow in British Columbia during the '90s. Furthermore, British Columbia is the only province whose housing stock growth rate still surpasses 2% annually. We do, however, see that the recent construction evolution was highly erratic, with a concomitant sporadic price and building surge in 1981 and high construction variations in 1991 and 1996.

3.5 Analytical Summary of Price Evolution

This review of the historical housing price evolution allows us to bring out the following findings. The New Housing Price Index probably underestimates the price growth of constant quality housing by approximately 0.5% per year. This price would be nearly stable in the long term if we judged it by the housing activity deflator. The price of housing financed under the *National Housing Act* is affected by sporadic biases stemming from the eligibility criteria based on property value. The most convenient housing price measurement is the Multiple Listing Service average sales price, called the MLS price, which has been available on a national basis since 1956 and on a provincial basis since 1960. This price shows a growth trend that is probably the result of an average annual housing quality improvement of approximately 1%.

Nationally, the real housing price experienced two major upward episodes, namely, in 1973-75 and at the end of the '80s. The periods in which the prices were high are furthermore systematically accompanied by an acceleration in new housing construction. A positive correlation between the real price and construction suggests that the demand shocks above all would be responsible for the price changes. Moreover, this national price avoids a wide provincial variability in the growth episodes, but the positive correlation between construction and price is nevertheless also found provincially. The similarity between housing stock growth and that of the number of constant headship rate households is compatible with strong long-term supply elasticity. This would mean that price increases would undoubtedly not be permanent. As seen in chapter 5, the econometric analysis will enable us to confirm this interpretation.

4. DEMOGRAPHICS AND HOUSING IN GENERAL INTEREST MAGAZINES

4.1 Foot and Stoffman: Two-Thirds of Everything

The subtitle of the introduction to the best seller that economist and demographer David Foot wrote in collaboration with Daniel Stoffman, *Boom, Bust & Echo: How to Profit From the Coming Demographic Shift* is a true promotional slogan. To state that two-thirds of the long-term economic phenomena can be explained by demographics is sufficiently catchy to attract the attention of the general public. The Foot and Stoffman text was, moreover, a resounding success. Written in a journalistic style, the thematic articles are based on examples meticulously selected to support the authors' point of view. Thus, it reads like a novel. But can their arguments stand up to close analysis? No scientific study is cited, no bibliography is provided.[21] Before presenting the reception the Foot and Stoffman contention garnered from Canadian real estate market specialists, let us look at the logic of their argument.

After drawing up a broad profile of the trends in commercial real estate, the authors state that the same reality applies to residential real estate. "During these two crucial decades—from 1967 to 1986—, approximately 9 million Canadians left their parents' home to set up residence in their own home. This inevitably created a phenomenal boom in the residential real estate market. It was just as inevitable that once the baby-boomers were housed, it would be the end of the boom [tr.]" (1997, 41). This valley was to last from 1988 until the end of the '90s "because the baby-bust generation that followed is 45% smaller than the baby-boom cohort [tr.]". Subsequently, "the baby-boom echo, which starts in 1980, will enter the housing market around the year 2000 [tr.]" (1997, 43). The echo households will first exert pressures on the apartment prices and once the transition age to ownership is reached, i.e. between ages 30 and 35, the construction of residential buildings in Canada will be re-launched. This recovery will be concentrated in the regions of the country "that actually have an echo generation", i.e. Ontario, the West and perhaps Halifax. "Other parts of Canada experienced an exodus of baby boomers and thus there will not be many baby-boomer children who will need apartments [tr.]" (1997, 43). But since the housing stock is large, "it is only in the second decade of the 21st century... that prices will increase again [tr.]" (1997, 45).

The other aspect of the Foot and Stoffman contention deals with the evolution of the dominant cohorts' needs and their impact on the changes in the composition of the demand. Hence, as the baby-boom generation ages, new needs emerge. Two examples are offered. First, in the mid-'90s, the echo generation is a generation of adolescents. They need space and a fair number of families have the means to offer it to them. Large homes will then be in high demand. Secondly, "at the same time as the children of the baby boomers are entering adolescence, their parents' desire to own a quiet place in the country is growing stronger [tr.]" (1997, 50). These buyers of recreational property situated at a reasonable distance from the large cities, "will be numerous enough to exert considerable pressure on the recreational property price". While only 8% of Canadian families currently own a vacation home, this percentage will increase significantly in the coming years.

The businesses that understood this trend have, according to Foot and Stoffman (1997, 51), hit the jackpot. The Vancouver firm Intrawest is the business cited as the example. The other big winners are the small resort towns such as Saint-Jérôme, situated close to metropolitan areas. These financially well-heeled baby boomers will even go as far as preferring to have a small city property that they use as a place to sleep during the week and a spacious home in the country from which they can only truly benefit during leisure time.

The essence of the Foot contention had already received some press and general interest magazine coverage. Magill (1993) quotes a text published in

the Toronto Star in 1986, in which Foot parallels the housing shortage in the major urban centres and the arrival of the baby boomers on the rental market. At that time he predicted that, "a dramatic increase in the demand for single-family homes will take the place of the rental crisis... If we do not prepare ourselves as quickly as possible for this reversal, the dream of having a house of one's own is likely to turn into a nightmare [tr.]" (1993, 87).

Can we say that this contention was original at the time of the publication of the book's English version, i.e. in 1996? In actual fact, several American authors had published similar texts in general interest magazines starting back in the early '70s.

4.2 A Trend Rising From the South

In 1988, similar arguments could already be found in certain American periodicals. The Miller text (1988) is a good example to mention. He maintains that: "... in the long term, there is a demographic foundation to the explanation of residential construction activities. The pace of housing activities reflects the growth in the number of households because most of the new housing units are built to meet the needs of new households, either directly or indirectly [tr.]" (1988, 35). In the short term, several variables can influence housing activity. Miller mentions the availability and cost of mortgage credit, the building costs, the price of the homes, the income and the wealth of the households that occupy the homes, as well as fiscal policy.

When he applies this logic to the American demographic trends, Miller foresees a decline in housing activity investments in the United States for the period from 1986 to 2000. In fact, by using the Bureau of Labor Statistics demographic projections, he estimates that the real residential investment will grow by 0.4% per year for this period, which is substantially lower than the 1.3% recorded from 1972 to 1986. In 2000, housing activity will represent 3.9% of the GNP as compared to 5.3% in 1986 and 6.2% in 1972. Thus, "the decline in household growth should almost certainly be reflected in the residential construction activities [tr.]" (1988, 48).

Hill and Peterson (1994) reiterate the argument in a text published in the Dallas Federal Reserve Bank's Economic Review. In this text, the authors attempt to evaluate the impacts of the projected demographic growth changes and the distribution by age group of the American population on the investments in housing activity until 2010. They maintain that the effects of the levelling off in the demographic growth have had a negative impact on this industry, causing a 17% decline in net housing activity investments from the end of the '80s to the mid-1990s.

The demographic phenomena should cause another investment decline in the range of 22% from 1995 to 2005 before experiencing growth after this date. Hill and Peterson (1994) discuss some implications of these trends on construction jobs and the price of homes. Hence, the job share related to housing activity compared to total employment should decrease by one third. As for the prices, they should not record a dramatic decline. However, some major price adjustments in the relative home price should occur between the different types of homes.

Some more detailed analyses of the contribution of demographic phenomena to the housing demand, the revisions of the demographic projections to take into account the effect of an increase in immigration and the addition of cyclical variable predictions to the models called into question the results of the partial analyses based only on the growth in the number of households. For example, Filardo (1996) shows that the demographic contribution must take three trends into consideration: population growth, the household formation rate and the structure of the population by age groups. He also shows the importance of the conjunctural factors to the explanation of residential housing activities. In his model, he includes variables to account for economic growth, interest rates and the consumer confidence level. He then obtains results opposed to those of Hill and Peterson (1994) regarding the evolution of activities in the residential construction industry.

4.3 A Positive Reception from Generalists

What kind of a reception did the Canadian general interest periodicals give the Foot contention? Among the generalists, the reception was actually very positive. A few examples illustrate the treatment received by *Boom, Bust & Echo*.[22]

Jean-Marc Léger (1997), from the survey firm Léger et Léger, mentioned the following subtitle: "In less than a year, David Foot, a professor at the University of Toronto, has become the most popular guru in Canada by stating that every year we get older [tr.]." Léger writes that, "this simplistic theory demolished the major analyses by futurologists Faith Popcorn, John Nesbitt or Alvin Toffler". Léger says he is "two-thirds" in agreement with Foot's argument holding that the aging of the population explains, in large measure, the major trends and major transformations in Canadian and Quebec societies. He maintains that the baby-boom generation has marked the social trends as it aged: hippies in the '60s, yuppies in the '70s or dinks [double income, no kids] in the '80s. Therefore, "a generation so numerous that it created the nature and the movements our society has been living for nearly 50 years". He concludes that the markets will have no other choice but "to adapt to an aging clientele".

Séguin's conclusion (1997) is just as eloquent: "Boom, Bust & Echo, a must read... and reflect!" The Canadian population is aging and its choices, habits and needs are changing. According to Séguin, this phenomenon must be considered for two reasons. First because "David Foot's study is the first to establish forecasts by associating demographics and statistics with the personal consumption profile. Hence, age will be the factor with the greatest influence on personal choices and habits". Then, because these demographic trends will have major repercussions on tax revenues.

Foot's arguments also receive support in the English Canadian press. Following the publication of his book, and even before, he was frequently interviewed to comment on the housing market evolution and especially on the prices. For example, a text published in the Financial Post Daily in February 1995 allowed Foot to explain the price trends in single-family homes. He maintained in it that, "without a large influx of immigrants, there will simply not be enough new buyers for the homes that the retired boomers will want to sell. In each of the lower age groups, there are 20% fewer people than boomers." Hence, the housing market "will be mushy over the course of the next 20 years". The analysts quoted support Foot's point of view saying that investment in a home will not be very profitable.

Certain provincial publications applied Foot's contention to the analysis of real estate market trends in a specific province. This is the case for the Kershaw article (1996) for British Columbia. Thus, to understand why housing activity flourished so much in this province in the early '80s, it is necessary to go back twenty or thirty years and verify the number of births.

The temptation to compare David Foot to other authors, who took an interest in the heavy social trends, fuelled a comment by Shannon Kari (1996) in the Financial Post. Foot's reputation and talents for popularizing serve him well. The use of the demographic phenomena to explain the long-term trends pleases the reader because it is a simple argument that can be supported by examples that affect the reader. Kari uses the housing case to justify her positive assessment of Foot's process.

Other readers allow themselves to be caught up in the two-thirds of everything game. This is the case, for example of Patricia Chisholm (1996) in *Maclean's*. Even if, at the outset, she writes "that too many factors are overlooked: the effect of science, policies and globalization", she manages to conclude that "nearly everyone who is concerned by the future will be able to learn from this new approach, even if it is sometimes restrictive, applied to many of the most pressing questions for Canada".

Lastly, certain analysts have used Foot's logic to show that housing needs would evolve. This is the

case for Rick Winchell, Executive Director of the Ontario Residential Care Association, who, being interviewed for an article in the Financial Post Daily (FPD, 1996), maintains that, "in the residential services sector, businesses will have to be more innovative in their responses to consumers' demands and needs". The aging of the population creates new needs for residential services, needs which are determined by age.

4.4 Exit Footmania

In the general interest press, the Foot contention was rapidly deflated by real estate market specialists. A short article published by Ross Laver (1996) in *Maclean's* is a good illustration of this rather cold reception. This author criticizes Foot for having overlooked the influence of several other variables on the real estate market: the fluctuations in economic activity, interest rates, changes in disposable income, zoning bylaws, the availability of land for residential neighbourhood development, etc. In actual fact, Foot and Stoffman (1996, 43) had acknowledged that factors other than demographics had an effect on the housing demand; however, these factors only "delay the inevitable".

The most virulent attack came from Frank Clayton, a real estate market consultant. In an interview granted to Laver, he maintains that Foot's analysis is simplistic and dangerous and that he "confuses a decline in the housing demand growth rate with a decline in total demand". By placing emphasis on only one of the structural factors that affect the housing demand, population growth, Foot overlooks other just as important structural factors and the cyclical factors such as the vigour of the regional economies. In the new edition of their book, Foot and Stoffman (1999, 55) respond to this criticism but by maintaining the demographic logic. They maintain in effect that, "just as some not insignificant demographic differences exist from one region to another, so the real estate market differs from one region to another".

Among the basic structural factors that Foot overlooks, Clayton mentions the changes in the household composition. Not everything has to do with demographic growth. The changing number of households and the emergence of non-traditional households must also be considered: adults living alone, single persons and couples without children.

But the principal weakness of the Foot and Stoffman analysis is, according to Clayton, having forgotten the contribution of supply. In the long term, the housing stock is not fixed and adjusts to the demand. This adjustment reduces the downward pressures on the price of homes. And Clayton concludes by stating that, in the future, "the rise in home prices might be more modest than in the past, but there is no reason to panic".

Others have attacked Foot's analysis in his own field, i.e., that of the demographic projections. This is the case with Baxter (1997) of the Urban Futures Institute of Vancouver. Baxter does not call into question past demographic data but instead disputes the implication of this data on the future housing demand. He accepts that the number of persons in the 25 to 34-year age group will decrease by 345,000 from 1996 to 2006. However, he stresses that the number of persons aged 15 to 24 years will increase by 350,000, that the number of those aged 35 to 44 years will increase by 100,000 and, above all, that the number of persons aged 45 to 64 years will increase by 2.5 million. The latter is the age group in which we find those who have the best possibilities of owning a home.

In the long term, according to Baxter, Foot is mistaken when he maintains that the baby-bust generation will have to buy the homes of the baby-boom generation because the latter will live in their homes longer. When they die, their children will already be at retirement age. Hence, the demand reduction that will accompany the baby-bust generation will be more than compensated by the growth in the younger and older age groups. "Assuming that the current immigration level is maintained between 210,000 and 215,000 immigrants per year, there will be no reduction in housing demand in Canada between now and 2095. There should be no periods during which supply exceeds demand, during which the market will collapse, during which, for demographic reasons, people would have to

withdraw from the housing trade. [tr.]" According to Baxter, between now and 2010, if economic growth holds steady, Canada should produce approximately 135,000 homes and 45,000 rental units per year. We are far from the chaos foreseen by Foot.

Foot's predictions also have trouble standing up to the facts. We saw above that, according to him, Canada was to experience a very calm housing market up to the end of the '90s. Yet Canada's economic performance revitalized the housing activity market. This is what Schofield (1998) maintains in *Maclean's*. Furthermore, Foot is quoted in this text. He defends his contention by maintaining that this good performance is attributable to generation X, i.e. Canadians between the ages of 32 and 38 who represent the tail end of the baby boom. The other analysts do not share this point of view. According to them, it is more a matter of a phenomenon basically related to the economic conditions: low interest rates, declining unemployment rate, increase in wealth transfers through inheritances and increasing consumer confidence.

Some other examples of incorrect predictions have been documented in the publications aimed at the general public. As a last example, we use the case of the most dynamic housing activity period Canada has experienced in the past 30 years. If we rely on Foot's contention, the number of inhabitants and their age should determine the housing demand. That being the case, when the oldest of the baby boomers reach the average age for buying a first home, i.e. 33 years, we should have seen the beginning of the most prosperous housing activity period in Canada. According to Taylor (1997, 97), Foot maintains that this is in fact the case and states that, "if we identify the steadiest strong housing activity period, we select the mid-'80s". This statement is, however, false. Taylor recalls that the most prosperous five-year period for the residential construction industry is that from 1972 to 1976. At that time, the oldest of the baby boomers were barely 29. Faced with this result, Foot defends himself by stressing that number of births had increased dramatically in Canada during the '40s and that builders had invested too much in housing activity in the '70s not being sufficiently aware of the demographic realities! He convinced no one however. Asked to comment on this result, Clayton replies that, "demographics are very important, but that the world is more complex than what one simple theory can explain" (Taylor, 1997, 97).

Hence, as Leckie (1998) reports, the importance of demographics appears to be largely overestimated. "Employment, interest rates and the general health of the economy have more of an effect on household spending than their age." And to conclude, Clayton: "Three factors must to be considered in the analysis of any housing market segment: the demographic and economic analysis, and the preferences". (Taylor, 1997, 97) The question is therefore to know what the real contribution of these different factors is. What does the specialized literature on this subject teach us? This is the theme of the next chapter.

5. EMPIRICAL DEMOGRAPHIC STUDIES ON HOUSING PRICES

5.1 The Laycock Study

Although demographics have long been recognized as a major determinant for housing starts, the literature says less regarding their impact on the housing price. The first study to detect and quantify such an impact in Canada is the one by Laycock (1978).[23] Commissioned by the Anti-Inflation Board to explain the high housing price increase between 1972 and 1974, this study attempts to establish whether this hitherto unprecedented increase in the housing price resulted from a new paradigm or whether it was the continuation of a same structural relationship. To do this, Laycock developed an econometric model tying the MLS price changes to a set of independent variables. The variables that he chose to explain the nominal housing prices were the real disposable income, the inflation rate measured by the growth rate of the Consumer Price Index, the real cost of credit, which he measured by the real interest rate on government bonds minus the inflation rate, housing stock and the population aged between 25 and 55 years. This model was a first difference estimate on the annual data covering the 1955-76 period.

Laycock describes the demographic influence on the housing demand in the following manner:

> *"Demographic factors are widely accepted as one of the most important influences on long-run demand. In the simplest terms, more people require more housing units. However, the situation is complicated somewhat by the fact that certain age groups of the population seem to prefer different types of accommodation. The rationale behind this implied link between age and type of housing is based on the "life cycle" theory which hypothesis[sic] that the young household first occupies an apartment and then desires a moderately priced single-family home or townhouse as the family head nears the age of 30. As affluence increases in middle age, the family is likely to upgrade its housing consumption. Finally, the household may move into a smaller retirement home or apartment as its members liquidate savings in later life."*[24]

Laycock therefore accepts that the demographic composition has some complex effects. In addition to the changes in population size that affect the total housing demand, the distribution of the different demographic groups can cause the demand to evolve differently for specific types of housing. However, given the inability to obtain price measurements for housing categories, Laycock limits himself to studying the general housing price level and therefore concentrating on a single population size measurement, i.e. those aged between 25 to 55 years.

After having restricted the effect of inflation on the housing price to being unitary,[25] Laycock shows that the most important influence is that of real disposable income. The elasticity of the price to income ratio reaches 1.60 and this coefficient is highly significant. He also finds an expected negative effect of the real interest rate and the housing stock. These two variables are also statistically different from zero. However, even though the effect of demographics on the price is positive, Laycock cannot reject at the usual confidence level, the hypothesis that the effect of this variable is statistically null.

5.2 The Mankiw and Weil (MW) Study

The Mankiw and Weil article (1989) was the first published in an arbitrator journal to present some empirical results making it possible to consider that the changes in demographic composition were going to cause the real housing price to decrease significantly. Based on American data, the principal forecast in their study is the following:

> *"If the historical relation between demand and prices continues to hold, it appears that the real price of housing will fall about 3 percent a year. More formal forecasting using the*

regressions yields the same answer. The regression in the first column of table 2 implies that real housing prices will fall by a total of 47% by the year 2007."[26]

The repercussions of this study were enormous. The written press echoed these forecasts widely. The scientific community also reacted strongly since Regional Science and Urban Economics simultaneously published five critiques in 1991. Later, at least five more articles were published that use or criticize the Mankiw and Weil approach (henceforth called MW). In order to understand this important contribution, we will first review the approach they adopted, which will make it easier to understand the criticisms.

The MW conclusions are based on the analysis of the relation between a demographic index (D_t) for the housing demand and its real price. This index is obtained by multiplying the population age structure by a coefficient measuring the intensity of the housing demand for a given age α_i. More precisely, this index is formulated in the following manner:

$$D_t = \sum_{i=1}^{n} \alpha_i N(i,t) \qquad (6)$$

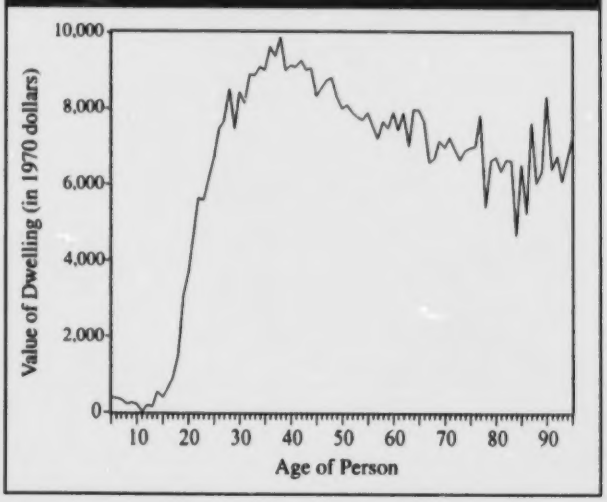
where $N(i, t)$ is the number of persons aged i at the date t. The α_i estimate was made based on a sample from the 1970 United States census and formed of 203,190 persons grouped in 74,565 households. A regression is performed for the purpose of explaining the value of the dwelling occupied by the people's age.[27] To do this, MW construct 99 mute variables called DUMMYi that assume the value 1 if age is i or otherwise zero. The parameter associated with DUMMYi is α_i and it indicates the estimated impact of a person's age on the value of a dwelling.

To understand the approach properly, certain points must be clarified. First, MW make no correction for the income or household structure modifications that occur when age changes. On the contrary, their variable captures the impact of age, as well as the effect on housing demand of all the variables that change with age. The following quote allows us to understand their position.

"Looking across individuals, the quantity of housing demanded is a function of age, income, and a variety of other household characteristics. Yet here we use data on only the first of these attributes: age. Our ultimate goal is to construct a variable on the aggregate demand for housing using information only on the age composition of the population. We are therefore not interested in the value of the true coefficient on age in a multiple regression. Instead, we are interested in the best predictor of a household's quantity of housing given information only age of its members. Any correlation of age with income and other household characteristics does not pose a problem - indeed, multicolinearity may be a strength, for it acts to eliminate any worry over the role of omitted variables."[28]

Figure 16 presents the estimated values of α_i in 1970 dollars. The housing demand rises rapidly in the early twenties, reaches a maximum at the end of the thirties to then decline gradually by approximately 1% per year after the age of 40. MW attribute this decline to the fact that older cohorts have earned a lower income during their life than

Figure 16:
Housing Demand by Age Estimated by Mankiw and Weil



that of the younger cohorts. To illustrate the importance of the increase in the housing demand for the younger cohorts, MW compare the profile of this housing demand life cycle with that obtained by estimating in a similar manner based on data from the 1980 census. Although the 1980 profile has the same broad shape as that of 1970, the real housing consumption in it is stronger for all the ages.

Having estimated the profile of the housing demand life cycle, MW then calculate D_t from 1940 on, by using the number of people of a given age. They make the calculation based on the 1970 profile and compare it with that of 1980. Even if the latter has a much higher level than the former, with a progression capable of reaching up to 50% for young households, the growth rate of Dt is very similar for both measurements. The maximum demographic effect on the housing demand occurred in 1977, at a time when demand was increasing by nearly 1.8% per year. The growth in demand subsequently declined rapidly however and is no more than 0.6% per year after 1997, the lowest rate observed since the Second World War.

In the next step, they estimate what the impact of D_t is on the housing stock and on the price. Their conclusions are diametrically opposed. While they find a negligible effect on the stock, they estimate an effect on the price that is statistically very significant and quantitatively large. This leads them to conclude that the price elasticity of both housing supply and demand are relatively weak. In essence, their result is based on the fact that at the end of the '70s, at the same time when the demographic variable was at its strongest, the real housing price reached its peak. By applying the model's estimated coefficients to the demographic forecasts of the United States, they anticipate that the real housing price will decline at an average rate of 3% per year between 1987 and 2007.

5.3 1991 Criticisms of the MW Model

A series of criticisms of the MW article was published in 1991 in Regional Science and Urban Economics, preceded by a presentation of the different aspects of these criticisms by Woodward (1991).[29] The following sections review these criticisms.

5.3.1 Engelhardt and Poterba: Analysis of Canadian Data

Engelhardt and Poterba (1991) copied the MW methodology with Canadian data. Since both countries experienced a baby boom of a comparable size at the same time, the demographic composition of these two countries is quite similar. The initial expectation is therefore that if demographics are the principal source of the movements in housing prices, we should find an influence on prices that is similar in both countries.

Engelhardt and Poterba thus estimate the α_i coefficients based on 12,734 households from the 1977 Canadian Survey of Consumer Finances. They observe that the Canadian profile grows less rapidly than that of the United States between ages 20 and 40 and that the housing demand reaches its peak at a later age, or between 40 and 45 years.[30] After that, housing consumption decreases at a rate similar to that observed in the United States. Having then specified a more complete model including the real GDP and the cost of use, they compare identical equations for explaining the housing price in Canada and in the United States. The demographic effect is radically different in the two countries. While they confirm the strong positive effect observed by MW in the United States, they obtain a negative effect for this same variable in Canada. This is explained by the fact that the real housing price evolved in a very different manner in the two countries, Canadian prices having experienced strong growth in the early '70s while the peak was reached near 1980 in the United States. In conclusion, Engelhardt and Poterba suggest that since the MW methodology does not manage to explain the prices in Canada, care must be taken before extrapolating the American price movements to future years.

5.3.2 Hamilton and the Price of Housing Services

Hamilton (1991) brings three contributions. First of all, he points out that in the MW equation, demographics will make the housing demand rise for at least the next thirty years. The forecast of a decline in real price made by MW does not therefore stem from an absolute decrease in housing demand. Instead, it is a trend in the equation that implies an average annual price decrease of 8.1% per year. Just to counterbalance the deflationary effect of this trend, the population must grow by 1.5% per year. To illustrate the absurdity of the extrapolations we can derive from such an equation, Hamilton points out that if the population suddenly became stationary, the real housing price would decrease by 97% over the course of the next 40 years.

Hamilton then stresses that if the price movements stem from shocks on the housing demand, the housing price should evolve in the same direction as the rental price. Yet, the movements of these two prices evolved in opposite directions during the '70s. A more plausible interpretation of these movements is the decrease in housing use cost resulting from the acceleration of inflation. This would be the decrease that would have been the principal cause of the strong growth in the housing demand observed in the '70s. To better support his argument, he shows that the MW demographic variable has a negative effect on the rental price.

Lastly, he remarks that when MW compared the 1970 and 1980 profiles, they stressed that the real housing consumption had grown considerably during that decade. Hamilton maintains that with some plausible values for housing demand income elasticity, the growth in real income in the '70s is not enough to explain this increase in consumption. The households in fact reacted as if they perceived a reduction in the cost of housing services during the '70s, which contradicts the contention holding that the rise in price stems from demographic pressures.[31]

5.3.3 Hendershott: The MW Equation has a Poor Forecasting Performance

Hendershott (1991) also criticizes the crucial and poorly explained role of the underlying variable included in the MW model. He takes his investigation further by analyzing the temporal stability of the MW equation. By breaking down the sample into two sub-periods, he obtains separate estimates for the periods from 1948-1969 and 1970-1987. This enables them to show first that the outside-sample forecasting performance of the MW equation is very poor. In fact, the estimates obtained for the 1948-69 period are unable to forecast the price movements of the '70s and '80s. While the model forecasts a 41% real price growth between 1970 and 1983, the growth observed was only 10%. Furthermore, during the second sub-period, the demographic variable has a much weaker and insignificant effect than in the first sub-period. Lastly, they add a capital cost measurement, as well as the real income, to the equation to study different forecasting scenarios up to 2007. They thus show that the equation can forecast a rise in price, rather than a decline, if a strong enough growth in real household income is projected.

5.3.4 Holland: Non-stationarity and Co-integration between Demand and Stock

Holland (1991) focuses his attention on the non-stationarity of the variables studied by MW. Granger and Newbold (1974) showed that the regression with non-stationary variables often produces spurious correlations. The MW results could be subject to this problem since they did not perform the tests for ensuring the stationarity of the variables. Holland therefore submits the growth rate of the housing demand and stock, as well as the level of the prices to the augmented Dickey-Fuller test.

Furthermore, to better circumscribe what might cause the variables' non-stationarity, he verifies whether these same variables are co-integrated. Co-integration is a property linking non-stationary variables. Some non-stationary variables are said to be co-integrated if there is a linear combination

of these variables that is stationary. This property is very important. It appears especially when the level of several variables obeys a correction process for imbalances. In the case of the housing market, if the supply reacts gradually to the demand so as to eventually make up for the imbalance the demand shocks may have created, the housing stock and demand will be co-integrated.[32] If this property is verified, these two variables are subjected to common stochastic shocks. This would tend to support the hypothesis that the demographic shocks are responsible for fluctuations in housing starts. If on the other hand we find that the prices and the demand changes are co-integrated, this would be indicative that the demographic shocks have long-lasting effects on the housing prices.

Holland first verifies that the null hypothesis of non-stationarity cannot be rejected for each of the three variables. Subsequently, neither can he reject the null hypothesis that the variations in the housing demand and stock are co-integrated whereas he rejects it between the variations in the housing demand and the real price. He thereby concludes:

> *"Thus, the growth of housing demand caused by the Baby-Boom appears to be the major factor behind increased real residential investment, but does not appear to be the major factor behind increased real housing prices."*[33]

He reinforces this opinion in a last section in which he once again studies the relation between the price and the change in demand. However, to avoid the spurious correlations, he uses the logarithmic variation of the prices, stationary series, which he explains by the second derivative of the demand logarithm and by the rate of change in the capital use cost. In this formulation, only the cost use appears significant. He concludes from this, like Hamilton, that the rise in housing prices in the '70s would be easier to explain by the rise in the inflation rate than by the rise in demand caused by the baby boom.

5.3.5 The Mankiw and Weil Response

Mankiw and Weil (1992) attempt to respond to the 1991 critics but add nothing new. They begin by stressing that their initial estimates were taken too literally. The last section of their study, containing a more complete model, suggests a more moderate price decrease in the range of 22%. However, their reply to the more specific comments is disappointing. They maintain that the reduction in housing rental prices in the '70s, raised by Hamilton and Hendershott, is so mysterious that it is the reason why they omitted this information in their first study.

> *"In our original work, however, we avoided using the CPI for rent because of the measurement problems with this series. The decline in measured rents over a period when all price indices rose dramatically is a mystery that needs to be explained".*[34]

In response to the remark that the downward trend of -8% per year they estimate is not plausible, they argue rhetorically that not including the trend is even less attractive. As for Hendershott, they would have preferred he extend the series rather than break into two a sample that is already short. However, they do not in any way discuss the instability of their estimates. In response to Holland's results, they say that they are happy that their demographic variable is correlated with the housing stock. However, they say that they are sceptical of the approach chosen by Holland to counter the spurious correlation problem between the price and the change in housing demand. As for the Engelhardt and Poterba text, they believe that he supports their work because the Canadian demographic variable is similar to the one they estimated for the United States. Even if they claim that they are disappointed to find the absence of relations between this variable and the prices for Canada, the strong drop in housing prices observed in the late '70s in Canada confirms that a 50% price decline is possible.

5.4 Later Criticisms of the MW Model

5.4.1 Poterba: The Importance of Local Markets

Poterba (1991) attempts to make a distinction between the different hypotheses likely to explain the real appreciation of housing in the United States in the '70s. What distinguishes this study from Engelhardt and Poterba (1991) is the attention that is focused on the local data in order to better identify the impact of demographics. He also tries to see if the prices are determined consistently with the efficient market hypothesis.

In spite of the efforts and the care taken to show this data, the scope of the results he presents is a bit disappointing. Since several lagged variables can be used to explain the housing price, he strongly rejects the efficient market hypothesis. The local data show a strong impact on the price, income and building costs but no statistical demographic influence.[35] The disappointing aspect of this study is its difficulty explaining the behaviour at the beginning of the '80s, when housing demand remained strong in spite of the rise in the capital use cost. Poterba thinks that the buyers extrapolated the past trends in such a way that the anticipation of capital gains probably sustained the demand.

5.4.2 Swan: The MW Model is Incomplete

Swan (1995) substantially revises the MW estimate by interpreting it as an incomplete demand equation. To complete the MW formulation, the following must be added, at a minimum: the real income per capita, a measurement for the housing use cost, as well as for its relative price. Initially, for the 1947-1987 period, he presents the simple correlation between certain measurements of the MW population, the housing stock and the demographic variable. From this initial comparison, he infers that the demographic variable constitutes an approximation of the total adult population, the correlation between these two variables being higher than 0.99.

After this, Swan develops the complete model. His principal equation expresses the per capita housing stock as a simple function of the per capita income and the relative housing price. He disputes the interpretation that MW give to the GDP in their equation. First of all, including the total GDP as MW did is the same as counting the population twice. Furthermore, the GDP plays a role in the housing demand through the permanent household income. It is therefore not just a measurement of the economic conditions as MW contend.[36]

To confirm that the variable D_t plays the same role as the adult population, he initially includes the two variables in an equation aimed at explaining the housing stock. In such a case, the total population variable is not significant. Subsequently excluding it, he cannot reject the hypothesis that the coefficient of D_t is unitary; the housing demand would therefore be proportional to this variable, just as if it were a per capita measurement. Furthermore, contrary to what MW find, it is highly significant in the housing stock equation. Swan moreover points out that the cross section used by MW presents a peak housing consumption at a relatively young age in comparison with the income peak, which is instead situated close to age fifty. When we combine this observation with the strong rise in housing demand in the '70s, this means that the variable D_t must be used with caution in the context of a chronological series.

Swan suggests another interpretation for the real price movements observed in the United States. He first notes the very strong correlation between the housing price and that of construction building materials. Two interpretations of this correlation are possible. The first is that the housing demand shocks modify the housing price and the derived demand for construction building materials. The elasticity of the housing supply price would thus be relatively low. The second inverts the causality. Shocks on the supply of materials would have influenced the housing building cost. With a relatively elastic housing supply, this substantially reduces housing prices. The correlation between the prices and the housing starts helps clarify the most plausible interpretation. The first interpretation in fact implies a positive correlation between price and housing quantities while this correlation

would be negative in the second case. Since he obtains a correlation of -0.374 in the United States between the volume of housing activity and the price of the materials, he concludes from this that the second interpretation is the most plausible.[37] Swan therefore concludes that the drop in price forecasted by MW has little chance of occurring without some substantial changes in costs.

5.4.3 Pitkin and Myers: The Confusion Between Age and Cohort

All of the preceding critics focused on different aspects of the model estimated by MW but do consider that their variable well captures the effect of the demographic composition on the housing demand. Pitkin and Myers (1994) criticize the use that MW make of their demographic variable. They recall that there is a potential bias in using longitudinal data to infer the results of chronological series. This bias is especially well known in the studies focusing on the life cycle since the main source of equity demand variation with age is the change in permanent income. The cross section data then give the impression that age contributes to a declining consumption profile, while in fact it is simply the effect of the lower permanent income of the older generations. To verify if the decline in housing consumption after age 40 is a phenomenon of aging or really a consequence of the lower permanent income of the older persons, Pitkin and Myers use cohort-linked cross section or CLCS data that make it possible to study a population's housing consumption profile over 30 years with the American 1960, 1970, 1980 and 1989 census data.

The crucial point of their analysis is the following. The consumption profile of a same cohort is radically different from that inferred from a cross section. Just like MW, they find that the housing demand increases rapidly with age between 20 and 40 years. However, contrary to MW, they show that far from declining after age 40, the housing demand continues to progress up to age 70. Even though the progression is less rapid after age 40, it nevertheless remains that the aging of the present generations beyond 40 years in no way leads to anticipating a decline in the housing demand.

> *"A pure cross-sectional estimate for 1980, the year used by Mankiw-Weil, overstates the 1990-2010 decline in the growth of aggregate housing demand by 45% in comparison with the three-decade average of the CLCS estimates."*[38]

5.4.4 Green and Hendershott: The MW Variable Challenged

Green and Hendershott (1996) challenge this variable and maintain that it is the partial age effect that properly measures the impact of aging while MW use the total effect. MW had already differentiated the two concepts but maintained that the total age effect measured the impact of aging more adequately because the characteristics of the household systematically evolve with age. Green and Hendershott take an inverse position and maintain that the total age effect is not an appropriate measurement.

They use the data from the 1980 American census to study a sample of 65,622 households. The value of the dwelling is initially explained by a hedonistic regression aimed at estimating the value of the characteristics of each dwelling. After that, the demand for the various characteristics of the dwelling is explained by age, education, income, household size, marital status and race. Furthermore, the regression takes into consideration the dwelling's cost of use to the owners. This cost varies according to the household's marginal tax rate, which is calculated according to the tables in effect in 1980.

These estimates allow them to compare the total and the partial age effect. They choose a given type of house by selecting a set of characteristics in order to calculate how the willingness to pay for a constant quality house varies with age. If no correction is made for the characteristics of the household, this willingness to pay declines from the beginning of the forties, according to the profile estimated by MW. However, if a constant composition is maintained of the characteristics that do not vary with age, like the level of education especially, the willingness to pay increases slightly with age. The principal cause

for this behaviour difference is that in the 1980 sample, seniors citizens are much less educated than the middle-aged persons.[39] With a lower lifetime income, they cannot pay as much for housing.

The essential point of this exercise is that when the generations who are currently middle-aged get older, they will be prepared to pay just as much as they do now for their housing because their level of education and their life cycle income will not decrease. It is therefore incorrect to project that the aging of the baby boom generation will cause the housing demand to decline in the coming years. Green and Hendershott do the exercise to calculate by how much demographics have modified the housing demand over the various decades since the war and how much it will vary until the 2020-2030 decade. They show that during the '70s, demand grew by nearly 40%, or more than double the growth observed in the course of the earlier decades. For each of the decades from 1990 to 2030, the growth in the demand will be stable at close to 10% per year. Consequently, the aging of the baby boom will not produce a decline in housing demand.

5.4.5 DiPasquale and Wheaton: Housing Price Dynamics

DiPasquale and Wheaton (1994) also maintain that the specification of the housing market must be complete to study the evolution of the prices. They develop a structural model of the homeowner housing market that contains a price determination equation and one for quantity. The demographic component is constructed from the number of households that form each year. Furthermore, because of the endogenous reaction of the headship rate to the housing cost and to the economic conditions, they construct another demographic variable in which the headship rate is forced to remain constant. Since they restrict themselves to only individual owner-occupied housing, these demographic variables are adjusted to take into account the ownership rate by age. The price equation also includes the housing rental price while the salary is included to measure household income. In order to capture the downward pressures on the prices that result from a surplus supply, they also add the ratio of the housing stock to the number of households.

Lastly, they discuss at length the fact that the price adjustment towards equilibrium is not instantaneous.[40] The importance of introducing this hypothesis is empirical. DiPasquale and Wheaton ascertain that when they add the lagged price for a period as an explanatory variable, this allows for a great improvement in the forecasting quality of the housing price equation. Such an observation indicates that housing does not behave like the efficient market theory anticipates.

To complete this model, they also estimate a housing stock determination equation. This is a partial long-term equilibrium adjustment equation in which the construction of new housing units reacts positively to the price and negatively to the number of units in the preceding period.[41] They also include some variables measuring the building cost and the land cost. Since such an equation has a relatively low explanatory power, they add two additional variables, namely the occupancy rate of the adult population and the average time required to sell a dwelling. The first of these variables constitutes a conjunctural indicator while the second measures the cost anticipated by the promoter for financing new housing.[42] Both these variables considerably improve the housing start forecasting quality.

The dynamic model is then used to simulate the effect of the American demographic projections on the housing market. The strong point of their analysis is the integration of the supply. When a demographic shock occurs, the reaction is initially felt on the price. However, a higher price stimulates the production of new housing which, in the long term, dissipates the impact on the price. The American demographic forecasts show that even if the rate of new household formation is going to slow down, the number of households will continue to rise. Their simulation confirms that, in spite of everything, the slowing will be enough to exert weak downward pressures on the prices during the '90s.

"The combination of slower household formation and an aging population will, on net, act as a negative shock to housing demand in the 1990s. The magnitude of the shock, however, is relatively small. Furthermore, the long run supply of housing is quite price elastic and this plays an important role in mitigating the effect of any negative shocks to the demand side of the market."[43]

5.4.6 Ohtake and Shintani: The Japanese Housing Market

To better grasp how population aging will influence the Japanese housing market, Ohtake and Shintani (1996) analyze how the variable D_t influences real prices in Japan. However, their study focuses attention on two elements missing from the MW study. They make a distinction between the short-term and the long-term effects and take into consideration the cohort effect in addition to the age effect. The first element therefore answers the Holland arguments, while the second is closely akin to the arguments raised by Green and Hendershott.

After estimating the variable D_t, they find that this variable has a positive and significant effect on the housing stock but that its impact on the price is negative and insignificant. This second result is similar to what Engelhardt and Poterba found for Canada. Ohtake and Shintani conclude from this first exercise that the long-term supply elasticity seems fairly large.

They find some additional results reinforcing this conclusion through the co-integration analysis. Having first of all found that the D_t logarithms for the housing stock and the housing price are not stationary, they then show that D_t and the stock are co-integrated. As Holland explains it, this means that the housing stock is dictated by the same movements as D_t. The plausible interpretation of this result is that, in the long term, the housing stock is very elastic in the long term. Furthermore, Ohtake and Shintani note that the real price is not co-integrated with D_t, which reinforces the absence of a permanent demographic impact on the housing price.

Having found a co-integration relation between the housing stock and D_t implies that there is evidence of error correction in a model containing the real housing price as an endogenous variable.[44] One of the elements determining price change is thus the short-term disequilibrium between demand and the housing stock. Ohtake and Shintani estimate such a model and find that it explains well the price movements observed in Japan.[45]

Lastly, a final and very interesting element in their study is that they explicitly estimate the cohort effect and the age effect. Like Pitkin and Myers, as well as Green and Hendershott before them, they ask if the decline in housing consumption with age might not be due to the fact that the seniors would have had a lower income during their life. They therefore estimate the cohort effect by simultaneously processing the data from 1984 and 1989. Once the cohort effect [is] corrected, they conclude that the housing demand grows continuously with age in Japan. Far from reducing the housing demand, the population aging should on the contrary cause it to increase.

5.5 Other Studies on the Relationship Between Demographics and the Housing Market

5.5.1 Fair and Dominguez: Demographics and Macroeconomic Equations

Fair and Dominguez (1991) study the effect of the population's composition on the large macroeconomic functions. One of the equations studied is the housing investment equation. Even though it is not directly a study on the housing price, it nevertheless estimates the impact of aging on the housing demand. It is therefore worthwhile looking at it.

The approach used by Fair and Dominguez presents some similarity with that developed by MW. They develop variables measuring the proportion of the population belonging to age group i. They then test whether the coefficients of these proportions exert a significant effect on the American macroeconomic equations. The main

difference from MW is that the estimate is made in chronological series rather than in cross sections. Furthermore, since they must estimate the coefficients pertaining to 55 separate age groups with fewer than 55 observations, they force the coefficients of the age variables to follow a quadratic age function.

Their study concludes that age influences most of the macroeconomic functions in a very significant manner. Its estimated effect on housing investment however takes the shape of a U so that the housing demand would be minimal at age 40. This shape is the complete opposite to that estimated by MW. Fair and Dominguez explain this difference in the following manner:

> *"Recall that the results presented in this paper suggest that prime-age people consume less housing* ***relative to their income*** *than do those older or younger. Therefore, the combined results indicate that prime-age people earn significantly more than those older and younger." (Emphasis placed by the authors)*[46]

Thus we again encounter the argument already used by Pitkin and Myers, by Ohtake and Shintani, as well as by Green and Hendershott: the age effect in the MW cross section poorly captures the real effect of aging on the housing demand. Contrary to the MW results, aging is therefore likely to raise the housing demand.

5.5.2 Ermisch and the Housing Demand in Great Britain

Ermisch (1996) uses a sample of 4,769 households in Great Britain having bought a home during the 1983-88 period to estimate the impact of age on the housing demand. This is a very instructive sample since it contains a great deal of information on the housing quality and the household characteristics, including of course age, income and the number of persons. This makes it possible to develop a very good real housing consumption index. Rather than being content with a quadratic age form as in Fair and Dominguez, Ermisch tests several functional forms. Invariably, the various specifications conclude that, even in controlling for income, age has a positive effect on real housing consumption. His preferred specification implies a ratio of real housing consumption elasticity to age of 0.0286. Although low, such elasticity implies that real consumption at age 70 is nearly three times higher than the consumption observed at age 20.

He then shows how the aging of the baby boom generation is going to influence the growth in the number of households in Great Britain. The current rate of net household formation, approximately 60,000 in 1999, is close to a minimum of approximately 40,000 for 2002. Thereafter, the rate of net household formation rises again until 2012 before experiencing a new downturn period. Starting in 2025, the total number of households will begin to decline permanently.

He obtains a temporal series on the housing demand by applying the estimated effect of age and income to the future cohorts and by maintaining the headship rate constant by age. His model implies two aging effects that work in opposite directions. Aging increases the housing demand because of a pure age effect. On the other hand, the rate of new household formation decelerates. By assuming an average annual GDP growth of 1% per capita and an income elasticity of 0.5 in the housing demand, the simulations he produces show that the second effect dominates the first. The growth of the housing demand will therefore start to decline, the shape of this growth copying fairly accurately the forecasted rate of household formation. By 2025, the model allows for anticipating an annual demand growth of approximately 0.1% per year, as compared with nearly 0.5% at present. Ermisch concludes by stressing that it would be necessary to make a model of the housing supply to extract forecasts on the evolution of the prices.

5.5.3 Holly and Jones: Co-integration between Housing Price and Real Income

Using some very long series starting in 1939 and ending in 1994, Holly and Jones (1997) study the long-term determinants of the real housing price.

The first part presents the evolution of the real housing price in Great Britain from 1939 to 1994. Then they formulate a model in which the real price is explained by the average real household income, by the housing stock, the ratio between loan values and income, interest rate and demographics. As a demographic measurement, they select the proportion of population aged 20 to 29 in order to measure the importance of the group buying housing for the first time.

The first aspect of their analysis is that of the co-integration between the real housing price and real income. They show in fact that these two variables are co-integrated. As explained earlier, co-integration implies that the shocks that permanently affect the real housing price and real household income are the same. However, the co-integration vector they estimate implies a long-term elasticity in the value of the dwelling as compared with real income of only 0.14, which is extremely low in comparison with the values usually found. Holly and Jones are moreover aware of this fact. Nevertheless, they estimate an error correction model for the real housing price.

Their equation illustrates that the following variables explain the change in real price. First of all, disequilibrium in the housing market significantly influences its real price. The adjustment speed towards equilibrium that they estimate is -0.11. This implies a rather slow return to equilibrium, since such a coefficient means that only 11% of the discrepancy with the equilibrium price disappears each year.[47] Among the other results to note, we stress the negative and significant impact of the real interest rate and the change in housing activity, as well as the positive and significant effect of demographics and the loan-value-to-income ratio. Holly and Jones complete their study by showing that the speed of return to equilibrium is asymmetrical, the return being more rapid when they are too high than when they are too low.[48]

5.6 Synthesis of the Results

The diversity of the approaches and the countries studied makes a synthesis of the results difficult. We nevertheless accept certain aspects that the literature has identified. The future housing demand will be subjected to three main influences, namely the evolution in the number of households, aging and the growth in real income. Apart from the normal uncertainties of economic or demographic projections, the principal point of disagreement is that we do not know whether population aging will increase or decrease the housing demand. While MW and Engelhardt and Poterba establish that housing consumption peaks at approximately age 40 to then gradually decline, the studies that have made a distinction between age and cohort effects find instead that household housing consumption continues to rise well beyond that age. As long as this issue is not clarified, it cannot be concluded that aging constitutes a negative factor on the aggregate housing demand. Only the MW study concludes that population aging will strongly reduce the real housing price over the course of the coming decades. Engelhardt and Poterba (1991) cannot support this conclusion for Canada.

The co-integration studies cause other results to emerge concerning the long-term determination of housing prices and stock. Hence, Ohtake and Shintani (1996), as well as Holly and Jones (1997), find that the housing price and real income per capita are co-integrated which implies that real income plays a critical role in the long-term determination of the real housing value. For Holland (1991), who showed the co-integration between the housing demand and stock, the demographic movements would have a long-term effect on the quantity of housing and not on their price. On the whole, this scientific literature tends to show that even if demographics can lead to a reaction in the housing price, this impact would be temporary because the future evolution of the real price will be dictated above all by the growth in the standard of living. The studies by DiPasquale and Wheaton (1994), Swan (1995) and Ermisch (1996) recall for their part that the price forecasts require a modelling of the housing demand and the supply.

6. THE EMPIRICAL MODEL

6.1 Specification of the Empirical Model

This section uses the lessons from the studies to specify a model of the Canadian housing market that comes to terms with the absence of consensus regarding the effect of age on the housing demand. In the second section, we presented a model of the housing market containing a demand equation and a supply equation. In chapter 3, we saw the principal measurements of the housing price, as well as the factors likely to influence housing demand and price. In this section, we present and estimate a complete econometric model of the housing market. This model is a system of two equations that endogenously explain the evolution of the real price and the number of housing units. The approach is similar to the one selected by DiPasquale and Wheaton (1994).

A structural model of the housing market presents several advantages as compared with the MW approach. First of all, it avoids the confusion between the age effect and the cohort effect. As we have seen, this distinction can completely alter the effect of age on the housing demand. Secondly, the structural model is capable of reproducing the estimated dynamics of the housing market while the MW model overlooks this effect. Thirdly, since the model is estimated on real data, we can be certain it is automatically calibrated to available data.

The accepted basic specification is the supply and demand system formed of equations 3 and 4', which we recall:

$$D_t = \sum_{i=1}^{n} D_{it} = \sum_{i=1}^{n} N_{it} h_{it}(X_t, P_t, U_t) = H_t(N_{it}, X_t, P_t, U_t) \qquad (3)$$

$$S_t = C_t(W_t, P_t) + (1-\delta)S_{t-1} \qquad (4')$$

To apply this model, the real price measurement must be specified in what manner the demographic changes will be measured and choose the variables entering into the exogenous variable vectors X_t and W_t. A convenient way of presenting the model consists, as in DiPasquale and Wheaton (1994), of making P_t of equation 3 explicit so that we obtain one price and one stock equation.

Choosing the real price variable is actually quite easy. As it has been available on a continuous basis nationally since 1956 and for seven Canadian regions since 1960, we select the real MLS price. However, we will have a brief discussion on the changes that occur when other price measurements are used. For its part, the housing stock is measured by the net housing stock estimated by Statistics Canada.[49]

Choosing the method of measuring the demographics is the most problematic aspect of the specification. To prevent the impact of the housing price on the household headship rate from lowering the estimated effect of demographics on the real housing price, a demographic variable must be chosen that does not react endogenously to the price. This therefore prohibits using the number of households because the headship rate is endogenous. However, it would be possible to use the number of constant headship rate households, such as that presented in Figure 11.

However, a more flexible approach was preferred. The effect of a population's size on the housing demand depends on the headship rate as well as the group's average income. In fact, if we increase the size of a population that has a low income, the impact on the housing demand will be less significant than if it is the size of a high income group that increases. When the number of constant headship rate households is used, we attribute a weighting of the different age groups proportional to the headship rate but that disregards the average income. To mitigate this last constraint, population growth for six age groups were selected, namely, the 15-24 years, 25-34 years, 35-44 years, 45-54 years, 55-64 years and 65 years and over. This approach makes

it possible to test the impact of the population growth in different age groups on the price. Hence, it is not assumed, as in MW, that the age effect is measured by a cross-section estimate that does not differentiate cohort effect and age effect. Neither do we stipulate, as in Holly and Jones (1997), that only one segment of the population is enough to measure the effect of demographic change. It will be seen shortly, however, that some tests of hypotheses for verifying the different groups' contribution to the demand make it possible to simplify the formulation of the demographic variables.

While the theoretical model in chapter 2 links demographics to the number of people present in each age group, we instead select the logarithmic difference of the number of people in the empirical model. Empirical reasons are what justify our choice. We will present the results to justify our decision. In none of the formulations explored does the size of the populations exert an impact on the price or housing starts.[30] On the other hand, population growth has shown itself to be a highly important variable for prices. The simple interpretation we give to this result is the following. The housing needs of a numerous but stable population are easily satisfied at a normal price because the housing stock has had time to adjust to the size of the population. It is only when disequilibrium exists between the population and the housing stock that an effect on the prices emerges. A high price must accompany rapid population growth in order to increase residential housing activity, while low population growth produces a low price that limits the housing starts.

Like most of the empirical studies, and especially Laycock (1978) in Canada, we include in the specification as an element of X_t the real GDP per adult. Furthermore, we add the nominal interest rate on 5-year residential mortgages in order take into account the effect of the amount of income devoted to mortgage payments. We anticipate that the effect of the GDP per adult is positive while that of the interest rate is negative. As for the cost of use, we select the measurement we presented in chapter 3. Furthermore, given the results of DiPasquale and Wheaton (1994) and Ohtake and Shintani (1996), we do not initially force the adjustment of the prices to conform to the efficient market hypothesis and we include the real price of the preceding period in the specification. Just as they had observed with the American data, this variable considerably improves the real price equation by allowing a gradual price adjustment. Furthermore, to allow the shrinking of the housing market to exert an effect on the real price, we include the housing vacancy rate. With regards to the specification of equation 4', it contains only the real price, the lagged stock, the vacancy rate and the rate of use of the construction sector capacities. This last variable is aimed at measuring the effect of cost shocks on the housing price.

The equations that we estimate are thus in the form of:

$$\Delta S_t = \beta_0 + \beta_1 P_t + \beta_2 S_{t-1} + \beta_3 \Delta Y_t + \beta_4 V_t + \beta_5 TUC_t + u_t \qquad (7)$$

$$P_t = \gamma_0 + \gamma_1 P_{t-1} + \gamma_2 R_t + \gamma_3 Y_t + \gamma_{41}\Delta N(15,24)_t + \gamma_{42}\Delta N(25,34)_t + \gamma_{43}\Delta N(35,44)_t + \gamma_{44}\Delta N(45,54)_t + \gamma_{45}\Delta N(55,64)_t + \gamma_{46}\Delta N65_t + \gamma_5 S_{t-1} + \gamma_6 V_t + \gamma_7 U_t + v_t \qquad (8)$$

where:

P_t is the MLS price logarithm divided by the Consumer Price Index,

S_t is the net housing stock logarithm,

Y_t is the logarithm of the ratio of the Gross Domestic Product to the population aged 15 and over,

V_t is the logarithm of the vacant proportion of the net housing stock,

TUC_t is the rate of use of the productive capacities in the construction industry,

R_t is the interest rate on 5-year residential mortgages,

$\Delta N(A,B)_t$ is the rate of change in the number of people between age A and age B, and

$\Delta N65_t$ is rate of change in the number of people aged 65 years or over.

We have constructed series for all of these variables since 1956, except for the rate of use of the construction industry capacities that is only available from 1962 onward. To determine if this model must be a level or first-difference estimate, it is necessary to verify whether the variables are stationary and if not, whether some co-integration relations exist.

6.2 Stationarity and Co-integration Tests

The presence of non-stationary variables or co-integrated variables has a great deal of importance in the selection of the estimating method because non-stationarity and co-integration influence the variance properties of the estimators. If we estimate the impact of a non-stationary variable on a dependent variable that is also non-stationary, the level of correlation between these variables can be spurious.[51] The correction that is then suggested consists of estimating the model on data differentiated with reference to time a sufficient number of times for the differentiated series to be stationary.

The spurious correlation problem occurs because these two variables tend to diverge persistently from their mean level. We identify three situations that make it possible to avoid the spurious correlation problem. The first is for the explanatory and dependent variables to be stationary. In such a case actually, the variables tend to return to their average level so that the deviation from average is not persistent. The second is for the dependent variable to be co-integrated with one or several explanatory variables. In such a situation, even if the variable's deviation around its average is persistent, it is caused by a shock that is shared with the one affecting the variable with which it is co-integrated.[52] Finally, the last situation that allows avoiding the spurious correlation problem occurs when the lagged value of the dependent variable emerges as an explanatory variable.[53]

Let us first see in which case the price equation is situated. The Augmented Dickey-Fuller test (ADF) applied to variable P_t requires including a deterministic trend and a lag in order to capture the dynamics. The value calculated is -2.507 while the MacKinnon critical value at 5% is -3.525. Since we cannot reject the null hypothesis that the real housing price contains a unitary root, the ADF test therefore confirms that variable P_t is not stationary.[54] In spite of everything, the problem of spurious correlation does not arise for two reasons. First of all, the lagged price appears in the list of explanatory variables. In addition, the ADF test with a lag and without a deterministic trend confirms that variable Y_t is non-stationary, the calculated value being -1.738 while the MacKinnon critical value at 5% is -2.936. However, the Johansen test between P_t and Y_t confirms that these two variables are co-integrated.[55] Hence, the shocks that make the real housing price rise tendentiously are the same as those that create the upward trend in real income per capita. The relation of standardized co-integration with reference to price is P_t - 1.058 x Y_t - 8.166. This means that in the long term, a 1% rise in real income is accompanied by a 0.945% increase in the real housing price. This therefore suggests a long-term income housing demand elasticity slightly lower than one.

The housing stock determination equation does not pose a spurious correlation problem either. In this case, the ADF test requires a deterministic trend and a lag to capture the dynamics of ΔS_t. This test does not allow rejecting the presence of a unitary root, which implies that the logarithmic change in the housing stock is not stationary.[56] In this case, the inclusion of the lagged stock value is not enough to eliminate the potential fictitious correlation problem because ΔS_{t-1} would have to be introduced instead. However, the co-integration test between ΔS_t and ΔY_t confirms that these two variables are co-integrated.[57] The level estimate can therefore be performed without encountering the spurious correlation problem. Contrary to Holland, we reject the existence of a co-integrating relation between housing stock and the adult population. This indicates that the persistent

shocks on the headship rate have made these two variables deviate from each other.

In summary, this analysis confirms that the shocks that have a long-term influence on the real housing price are common to those that cause the real income per adult to change. Although the statistical analysis does not allow for clarifying the causal relation, economic logic suggests that it is the underlying increase in real income that makes the real housing price rise. The system's two equations can be level-estimated without the estimators being subject to the problem of spurious correlation. The next section shows the results from the equation system.

6.3 Estimate Results

Equations 7 and 8 constitute a system of equations that must be estimated simultaneously. Since the real price is endogenous and emerges as an explanatory variable in 7, the ordinary least squares estimate does not allow for reaching estimates without biases. This problem must be mitigated by using an instrumental variable estimation technique. Furthermore, more effective estimators are obtained by taking into account the correlation between the error terms of the two equations. The system's three-step least squares estimate allows both problems to be taken into account.[58] The list of instruments must then include all the model's exogenous variables. Furthermore, a first estimate revealed that the residuals from equation 7 have a positive first order autocorrelation. Therefore a coefficient is included to account for the first order random error autocorrelation and add to the instrument list all of the lagged exogenous variables in equation 7, as well as the lagged value P_t.[59] The model is estimated on the annual data from 1963 to 1997, i.e. 35 observations.

This first estimate allows clarification of which are the significant variables and which can be eliminated from the specification. It is possible to simply the model in the following way. The χ^2 joint hypotheses test $\beta_4=0$, $\beta_5=0$, $\gamma_{41}=0$, $\gamma_{42}=\gamma_{43}$, $\gamma_{42}=\gamma_{44}$, $\gamma_{45}=0$, $\gamma_{46}=0$, $\gamma_6=0$ and $\gamma_7=0$ has a value of 15.56 and a marginal level of 0.07. This means that three variables can be omitted from the model, namely the vacancy rate, the capacities usage rate and the cost of use. Furthermore, the population growth in the 15-25 and 55 and over age groups has no measurable effect on the housing price while the effect of population growth in the 25-34 age group is identical to that of the groups aged 35-44 and 45-54. Consequently, the model can be summarized in equations 9 and 10.[60]

$$\Delta S_t = \beta_0 + \beta_1 P_t + \beta_2 S_{t-1} + \beta_3 \Delta Y_t + u_t \quad (9)$$

$$P_t = \gamma_0 + \gamma_1 P_{t-1} + \gamma_2 R_t + \gamma_3 Y_t + \gamma_4 N(25,54)_t + \gamma_5 S_{t-1} + v_t \quad (10)$$

where $N(25,54)$ is the population growth of the group aged 25-54. The results estimated for the period from 1958 to 1997 are presented in Table 3. The variable D represents the first order random error autocorrelation coefficient.

These two equations underwent thorough investigation to verify the quality of the specification. The Lagrange multiplier test does not allow for rejecting the hypothesis that the successive residuals are independent. The stability of the parameters was also verified. Only the Chow-Fisher test with a sample interruption date in 1977 proves significant. However, the problem seems very time-related because if the interruption date is varied by two years more or less, the stability of the equation's parameters cannot be rejected. In addition, the CUSUM test, as well as the CUSUM squared, does not detect significant instability at that date. It can be concluded from this that the system is well specified. Furthermore, the Jarque-Bera test applied to the residuals from equations (9) and (10) has a calculated value of 0.68 for the first and 0.24 for the second. Since their marginal levels are situated at 0.71 and 0.88 respectively, we cannot reject the normality of residuals hypothesis so that the three-step least squares estimate is asymptotically efficient.

Figure 17, which compares the values observed and obtained, shows that the model reproduces the movements of the endogenous variables very well. We further verified the soundness of the results to a change in price measurement. To do

this, we also estimated the equation system in the same period by using the real price weighted by the WEIG.MLS inventories. This does not change the sign of any explanatory variable and the estimated coefficients change little. The one that reacted the most to this change in variable is γ_4, since the estimated impact of population growth is cut in half to 2.25. The housing stock price therefore reacts less than the average real estate transaction price to demographic shocks. It is further noted that since the estimated standard deviation of the coefficient remains similar, the reduction of the coefficient acts in such a way that the marginal level of the variable's significance then reaches 20%.

The system with the real new housing price NHPI was estimated. Due to the more limited availability of this series, the estimate focuses on the 1971-1997 period. Again, all of the variables remain the same sign and significant. The demographic effect is thus almost identical to that estimated with the real MLS price, namely 4.76 and the variable is therefore highly significant. On the other hand, the effect of the price on the stock change, just as the effect of the lagged stock on the price, is greater. This suggests that the new housing price adjustment dynamics are faster than those of the sales price.

Table 3:
Results of the Equation System (Three-step least squares)

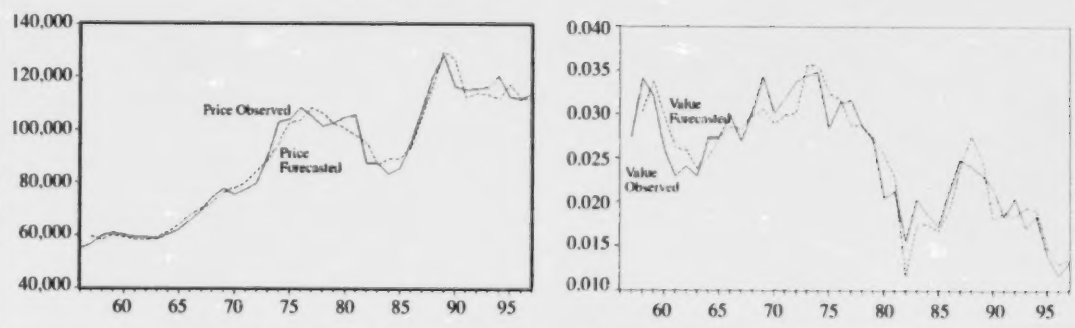
Estimated Equation: $\Delta S_t = \beta_0 + \beta_1 P_t + \beta_2 S_{t-1} + \beta_3 \Delta Y_t + u_t$

	Coefficient	Standard Deviation	Student's *t*
β_0	0.283697	0.050321	5.637729
β_1	0.041919	0.007662	5.470800
β_2	-0.046651	0.006487	-7.191881
β_3	0.058849	0.016036	3.669680
P	0.587959	0.121218	4.850422
$R^2 = 0.864$		Standard Deviation = 0.0025	

Estimated Equation: $P_t = \gamma_0 + \gamma_1 P_{t-1} + \gamma_2 R_t + \gamma_3 Y_t + \gamma_4 N(25,54)_t + \gamma_5 S_{t-1} + v_t$

	Coefficient	Standard Deviation	Student's *t*
γ_0	6.308495	1.236329	5.102602
γ_1	0.764720	0.062205	12.29352
γ_2	-1.190580	0.284833	-4.179916
γ_3	0.841898	0.167641	5.022045
γ_4	4.741296	1.516625	3.126215
γ_5	-0.389039	0.118534	-3.282077
$R^2 = 0.976$		Standard Deviation = 0.0417	

Figure 17:
Comparison of Values Obtained and Forecasted



6.4 Interpretation of Results

6.4.1 Statistical Impact of Shocks

The explanatory power of these two equations is very high. The market adjustment dynamics arising from them are completely in accordance with the theoretical model in chapter 2 drawn from DiPasquale and Wheaton (1994). In the absence of significant supply shock variables, the price reacts above all to demand shocks. The nominal interest rate has a very marked negative effect. A one percentage point increase in interest rates reduces the real price by 1.19%. On the other hand, a 1% increase in real income raises the price by 0.84%. Acceleration in the growth of the population aged 25 to 54 has a very significant positive effect on the real price since a 1 percentage point increase in this age group's population growth rate causes the real price to rise by 4.74%. Lastly, the coefficient associated with the price in the preceding period is 0.76. Since the real price is not independent from the preceding price, this initially undermines the efficient market hypothesis. We recall however, that since the price data make no adjustment for housing quality, we cannot make a direct conclusion as to the rejection of the efficient market hypothesis because the price persistence may be the result of the persistence of a shock on quality.

6.4.2 Dynamic Impact of Shocks

The adjustment dynamics of the model are relatively complex. First of all, the stock variation equation has a positive autoregressive root, which in itself introduces a persistent ΔS reaction. Similarly, P_{t-1} appears in the P_t equation so that the shocks on the prices are themselves persistent. Hence, any shock that alters the price produces a long housing starts reaction, which in turn forces the price's gradual return to its equilibrium value.

However, even if the shocks on prices tend to last for a certain amount of time, they do not last forever. This stems from the fact that γ_1, the coefficient associated with P_{t-1}, is less than one. In such a case, the price naturally tends to return to the long-term value dictated by the co-integration relation with real income. Furthermore, the stock adjustment dynamics help to somewhat accelerate the return to the price's long-term value. In fact, a 1% increase in S_t lowers the real price by 0.39% in period $t+1$. Yet, the ΔS_t equation shows that a 1% drop in the real price slows housing stock growth by 0.042%. Hence, from the direct coefficient of P_{t-1}, which is 0.7647, we remove 0.0163, i.e., is the product of -0.39 and 0.042. This means, therefore, that any shock on demand that initially raises the real housing price has, as the theory suggests, the effect of increasing the level of housing starts, which in turn reduces the housing price. It is further stressed that this equilibrium value is not fixed. The real price is subjected to ongoing shocks common to those on the real income per capita and therefore follows a stochastic upward trend.

To better grasp the prices' speed of adjustment to exogenous shocks and the importance of the dynamics, we simulated the model's reaction to different shocks. To do this, we defined a baseline scenario and then calculated how the price differs from this scenario after the shock.[61] Figure 18 compares the reaction to two types of demographic shocks. In the first, the growth rate increases by 1% in only one year. As previously indicated, the price initially rises by close to 5%. It is then subjected to downward pressures but remains higher than in the baseline scenario until the eighth year. Starting in the ninth year, the price becomes slightly weaker than in the baseline scenario before gradually returning to the same equilibrium value. The second type of shock is a permanent increase of 1 percentage point in the population growth rate. In this case, the price increases continually the first eight years and surpasses the baseline scenario price by 16%. Afterwards, the price begins to decline again but permanently remains at a real price 8.5% higher than that of the baseline scenario. This higher price is necessary to ensure a faster new housing construction rate than in the baseline scenario. We stress that since the price influences the ΔS_t equation, the rate of new housing construction reacts to demographic changes. Hence, even if no demographic variable appears in this equation, it

confirms that the growth in the number of households is, as in Lewis (1997), an important determinant of construction activity. It will be shown, however, that this impact is necessarily affected by a change in the real housing price, therefore in the profitability of investments in this sector.

The price reaction to a shock on real income was simulated by making a distinction between two types of shocks, namely, a temporary increase and a permanent increase of 1% in real income per capita. Figure 19 shows that the dynamic reaction of the housing price to these two shocks is similar to that resulting from demographic shocks. If it is a permanent shock, the increase in the housing price grows until it reaches 2.7% after 8 years but the permanent effect is only 1.5%. In the case of a temporary income shock on the other hand, the effect of the price increase diminishes rapidly and becomes negative beginning in the ninth year. Therefore we find no permanent effect on the price.

Figure 18:
Dynamic Price Reaction to Demographic Shocks

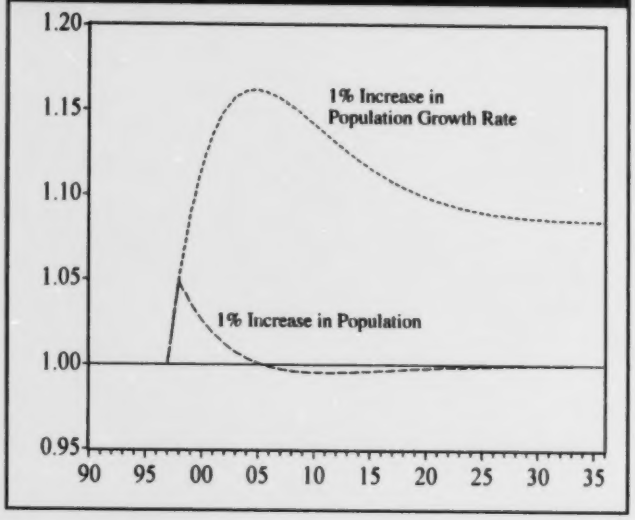
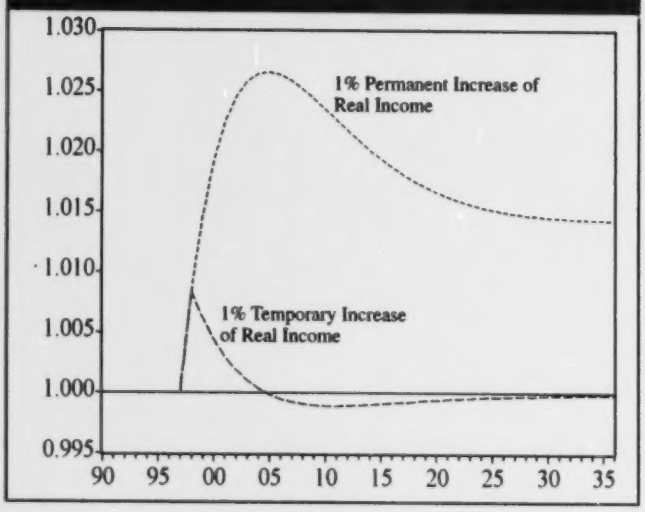


Figure 19:
Dynamic Price Reaction to Real Income Shocks



6.5 Provincial Estimates

Since the data are also available provincially for Canada, some separate provincial models were estimated. There are however two limitations. First of all, due to the absence of separate housing price data for each of the Atlantic Provinces, these four provinces must be grouped into a single region. Furthermore, the model's provincial estimates cover the period from 1962 to 1997, or six years less than for the Canadian model. The same estimate methodology is used, namely the three-step least squares, to obtain the results displayed in Table 4.

Generally speaking, the provincial housing activity equations are similar to the Canadian equation. In fact, the parameters have the expected sign and are, for the most part, significant. Hence, the lagged housing stock for one period has a negative effect on the housing stock variation and on prices. It is noted, however, that in the three Prairie Provinces, the change in real income does not have a statistically significant effect on construction, which indicates a lower conjunctural sensitivity in housing construction. Furthermore, the stock equation for British Columbia does not succeed in accounting for three important changes

Table 4:
Results for the Provinces
(co-efficients followed by the standard deviation in parentheses)

	Atlantic	Quebec	Ontario	Manitoba	Sask.	Alberta	B. C.
Estimated Equation: $\Delta S_t = \beta_0 + \beta_1 P_t + \beta_2 S_{t-1} + \beta_3 \Delta Y_t + u_t$							
β_0	-0.2969 (0.3266)	0.1445 (0.3226)	0.3342 (0.0534)	0.2444 (0.1892)	-0.1002 (0.0780)	-0.1246 (0.0810)	0.3636 (0.0582)
β_1	0.0526 (0.0208)	0.0324 (0.0158)	0.0410 (0.0196)	0.0348 (0.0116)	0.0443 (0.0047)	0.0607 (0.0068)	0.0377 (0.0086)
β_2	-0.0202 (0.0112)	-0.0333 (0.0156)	-0.0526 (0.0054)	-0.0481 (0.0137)	-0.0295 (0.0059)	-0.0401 (0.0054)	-0.0558 (0.0096)
β_3	0.0371 (0.0179)	0.0788 (0.0216)	0.0489 (0.0196)	0.0306* (0.0205)	-0.0142* (0.0101)	0.0209* (0.0269)	0.0117 (0.0405)
ρ	0.7330 (0.1906)	0.7847 (0.1043)	0.3982 (0.1506)	0.6933 (0.1212)	0.1226 (0.1282)	0.4451 (0.1297)	0.0213 (0.1617)
R^2	0.7695	0.8680	0.8738	0.7393	0.7514	0.8886	0.5211
Std. Dev.	0.0031	0.0032	0.0033	0.0038	0.0046	0.0055	0.0074
Estimated Equation: $P_t = \gamma_0 + \gamma_1 P_{t-1} + \gamma_2 R_t + \gamma_3 Y_t + \gamma_4 N(25.54)_t + \gamma_5 S_{t-1} + v_t$							
γ_0	5.5806 (0.9398)	2.2499 (0.9896)	-3.7997 (0.8091)	2.4831 (0.6981)	7.0095 (1.3499)	-0.7773 (0.0802)	-5.2561 (2.3218)
γ_1	0.4878 (0.0848)	0.6715 (0.0684)	0.7017 (0.0469)	0.9496 (0.0645)	0.7342 (0.0735)	0.7719 (0.0802)	0.7910 (0.0985)
γ_2	-0.0075 (0.0025)	-0.0117 (0.0027)	-0.0077 (0.0024)	-0.0122 (0.0033)	-0.0076 (0.0040)	-0.0105 (0.0042)	-0.0094 (0.0059)
γ_3	0.3541 (0.1853)	0.7095 (0.2231)	1.4945 (0.2152)	0.6074 (0.1954)	0.4482 (0.1348)	0.8998 (0.1718)	1.0416 (0.4743)
γ_4	4.1358 (1.1028)	2.7772* (1.5544)	1.6018* (1.2035)	2.9344 (1.0933)	4.3532 (0.7944)	2.3806* (1.2710)	5.5448 (2.0027)
γ_5	-0.2431 (0.1232)	-0.3697 (0.1303)	-0.5100 (0.0977)	-0.6072 (0.1576)	-0.6640 (0.1647)	-0.4298 (0.1023)	-0.1951 (0.2284)
R^2	0.8160	0.8503	0.9778	0.9362	0.9287	0.9698	0.9609
Std. Dev.	0.0377	0.0382	0.0397	0.0406	0.0564	0.0514	0.0816

The asterisk * indicates that the variable is not different from zero at a marginal level of 5%.

in housing activity that occurred in 1991, 1992 and 1996 in this province[42], which significantly reduces the multiple determination coefficient. The addition of mute variables to react to the movements of these three years allows raising the model's R^2 to the same level as in the other provinces, but their presence considerably lessens β_3. In the absence of clear indications that the movements of these three years are attributable to exceptional events, basic model is not modified for this province.

The price equations too are, generally speaking, in accordance with the Canadian estimate. In all of the provinces, demographics have an estimated positive effect on the price but the coefficient is

not statistically different from zero in three provinces, namely Quebec, Ontario and Alberta. The nominal interest rate has a negative effect on the price in all of the provinces. Furthermore, the coefficient associated with P_{t-1} is statistically lower than one in each of the systems except in Manitoba. In this latter case, the coefficient of 0.94 is not different from 1 at the normal confidence level so that the price equation can produce explosive answers. It is also necessary to stress that the coefficient associated with income in Ontario is 1.49, which is exceptionally high. Such a value seems a little implausible to us, in view of the values estimated in the other provinces. It is probable that the model associated with the growth in real income during the '80s reflects the housing price increase that would have resulted from real estate speculation in this province during that same period. Similarly, it would be associated with the drop in income during the 1990-92 recession, the real estate deflation observed when the speculative bubble burst.

In summary, the structural model suitably reflects the data at both the Canadian and provincial levels and makes it possible to analyze the dynamic housing price and stock reaction to shocks. However, it is probable that the Ontario model presents an overly high real income coefficient and that the one for Manitoba creates unusually large and persistent price responses. Nevertheless, since these models faithfully reflect the historical behaviour of the prices, they can be used first of all to measure the contribution of demographic shocks and then to make price projections according to various scenarios.

7. HOUSING PRICE PROJECTIONS

7.1 Analysis for the 1956-1997 Period

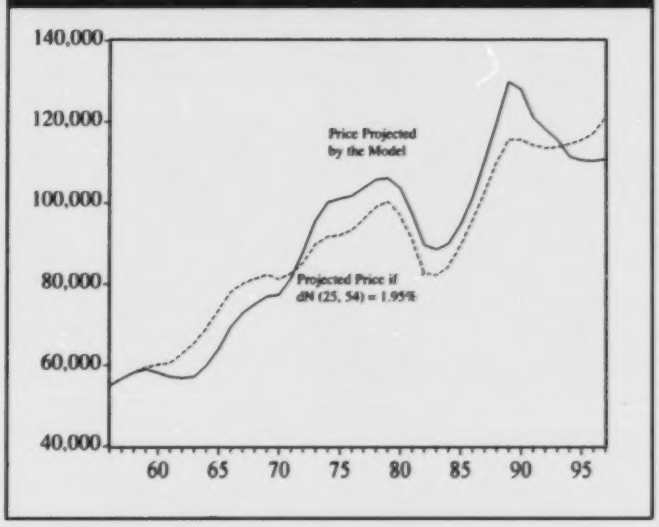
We first use the model to better understand the impact of the shocks on the evolution of the real price during the period from 1956 to 1997. We are trying to clarify two points. First of all, to measure the contribution of the demographic wave associated with the baby boom, we calculate how the real housing price would have evolved if the population growth rate had always stayed at its average level of 1.95% per year. Then we want to know whether the demographic shock was a more important source of housing price disruption than the economic fluctuations or whether, conversely, the latter were dominant. To do this, we calculate the price evolution if the real income per capita had risen steadily by 1.58% per year, i.e. its average level for the period.

7.1.1 Demographic Impact

Figure 20 compares the model's projections according to the historical values of the exogenous variables with those obtained by assuming a constant population growth rate. This comparison allows three phases to be identified. The first, starting in 1959 and ending in 1971, is characterized by slow growth in the population aged 25-54. During this entire period, demographics contribute to lowering the real housing price with a maximum effect in 1965, when the price is 14% lower than what would have been observed if population growth had been constant. The acceleration of demographic growth starting in 1966 contributes to correcting the housing price, which enters a second phase in 1971. This phase, which will last until 1992, was characterized by an approximately 8% higher real price according to the historical values than in a scenario of constant population growth. The maximum demographic effect occurred in 1989 when the price had been pushed up 12.3% by demographic pressures. Beginning in 1990, population growth rapidly diminishes so that in 1993, we enter a third phase of weakened real prices. The impact on the real price does not stop strengthening until 1997, when the real price is 8.4% lower that what we would observe if demographic growth had always remained at 1.95%.

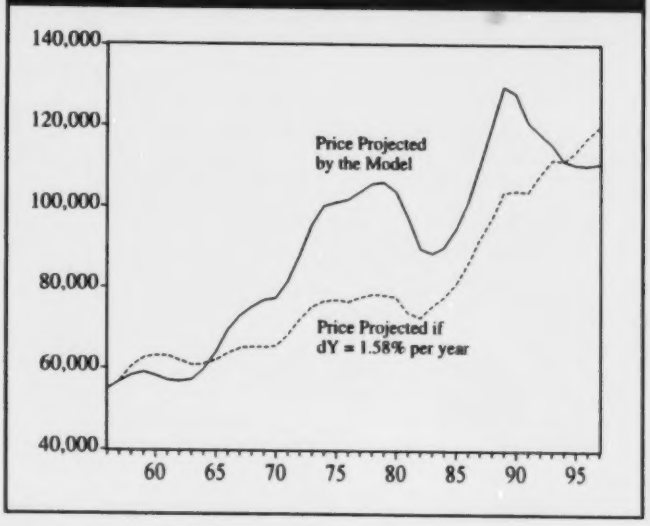
The model therefore indicates that, because of purely demographic factors, the real price rose 25% between 1965 and 1975, then decreased 20% between 1989 and 1997. The model shows that even with a constant population growth, the real price would have experienced a significant drop between 1980 and 1982 due to the rise in interest rates and the rapid and marked decrease in real income. This decline would have been followed by a rapid rise in the real price between 1983 and 1989 owing to the relaxing of the interest rates and the strong growth in real income. The 1990-92 recession however, would have put the brakes on real estate inflation. Furthermore, because of the weakness of the economic renewal between 1993-95, the real price would only have experienced significant growth beginning in 1996. The net result for 1997 is that the average real MLS price would have been $120,812 instead of the

Figure 20:
Baby Boom Impact on Real Housing Price



$110,668 price projected by the model. It is further stressed that the model forecasts that with constant demographic growth, the construction of new housing units would still have experienced wide fluctuations associated with the economic conditions. However, the housing stock growth would have been 2.1% in 1997 instead of 1.3%. This confirms the importance of demographic factors in the reduction of housing starts in the '90s.

Figure 21
Impact of Real Income Growth



7.1.2 Impact of Economic Conditions

We now simulate the real-term path of the housing price if the real GDP per capita had experienced constant 1.58% growth per year between 1956 and 1997. Figure 21 shows that due to the strong growth in real income from 1963 until the end of the '70s, the real housing price was 36% higher in 1979 than the value it would have had if economic growth had been evenly distributed across all of the years. In 1989, this price discrepancy was still more than 23%. However, the economic situation was so bad after 1990 that in 1997, the real price was 8% below the value that would have been observed if economic growth had remained constant, i.e. $110,668 instead of $119,915. The decrease in real income therefore contributed to lowering the real housing price by more than 31% between 1989 and 1997 because, instead of the 14.7% decrease observed, the real price would have grown 15.8% during this period.

It is interesting to further note that the price fluctuations caused by the shocks on real income quite closely coincide with those stemming from the demographic changes. Hence, because of the two types of shocks, it is between the mid-'70s and the end of the '80s that the economic conditions and demographics made the greatest contribution to maintaining high prices, while it is in the '90s that the downward pressures were felt the most. This implies that if we neglect to take the economic conditions into account, it is easy to attribute an unduly large share of the housing price fluctuations to demographics.

7.2 Projections for the 1998-2016 Period

The estimated model is now used for forecasting the evolution of the real price in order to verify whether the predictable demographic and economic changes are likely to significantly alter the real price. To complete this exercise, we first of all establish in the first section some scenarios dealing with the future evolution of three exogenous variables, namely, population growth, real income growth per adult and the future level of interest rates on residential mortgages. Afterwards, the next section shows the forecasts until 2016 according to various scenarios. Finally, the last section presents the projections drawn from the provincial models and compares them to that obtained by the Canadian model.

7.2.1 Demographic and Economic Projections

Three exogenous variables condition the model's behaviour, namely, interest rates, population and real income. For all of the projections, the assumption is made that the interest rate on residential mortgages will remain at 7.5% over the course of the next 20 years. This assumption

seems realistic to us and reflects the average of the interest rates observed in the past two years and used to estimate the model, that is 1996 and 1997.[63]

The demographic projections are based on three scenarios established by Statistics Canada in 1993, namely those of weak, medium and strong population growth. These projections share three common hypotheses on the subject of emigration (5-year average of the emigration rates by age and gender), of transient residents (from 1995, constant total number of 149,600) and of Canadians who return to the country (obtained by taking 50% of the projected emigrants over a decade) and are differentiated by the assumptions on fertility, life expectancy, immigration and internal migration. Table 5 presents the assumptions associated with each of the projections.[64]

Figure 22 shows the growth rate observed for the population aged 25-54 between 1956 and 1997 and that projected starting in 1998 according to the three scenarios. The figure demonstrates eloquently that, even in the strong growth scenario, the 25-54 age group population will increase more slowly than it has for the past 40 years. The declining growth being particularly rapid between 2000 and 2002, this is the period during which maximum downward pressures on the price must be contemplated. However, it is also necessary to note that even if the population growth rate is weaker, the decline in the growth rate will never be as pronounced and dramatic as between 1989 and 1995. This leads us to foresee that the demographic pressures will be on the decline in the course of the next 20 years, but that the impact on the price will not reach that observed since 1990. Lastly, we note that only if the weak growth scenario occurs might the population in this age group decline, and after 2009.

Since the real price and the real per capita income are co-integrated, the projected growth in real

Figure 22:
Population Growth Projection for the 25-54 Age Group

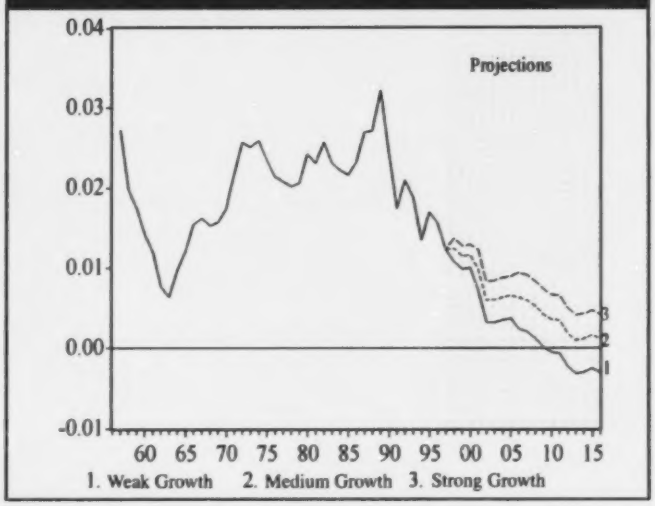


Table 5:
Hypotheses for the Demographic Projections

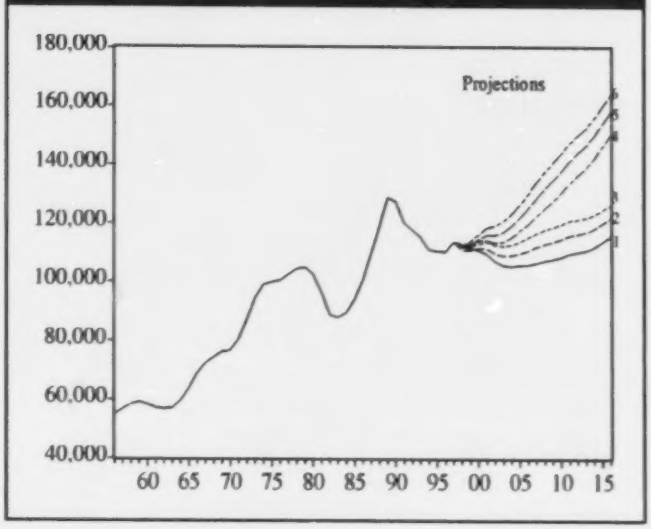
DEMOGRAPHIC PROJECTIONS SCENARIOS	TOTAL FERTILITY RATE IN 2016	LIFE EXPECTANCY BY GENDER IN 2016	IMMIGRATION LEVEL IN 2016	INTERNAL MIGRATION TRENDS
1. Weak growth	1.5	Women: 83.0 Men: 77.0	150,000	Favouring Central Canada
2. Medium growth	1.7	Women: 84.0 Men: 78.5	250,000	Average
3. Strong growth	1.9	Women: 86.0 Men: 81.0	330,000	Favouring Western Canada

income will be the critical element in the underlying future evolution of the real price. Given the inability to forecast the dates of economic fluctuations, the most realistic method for constructing an income projection consists of extending the past trends. During the 1956-97 period, the real GDP per adult grew an average of 1.58% per year. However, growth was more rapid until the mid- '70s and much slower thereafter. Hence, the average real GDP growth rate during the period from 1978 to 1997 was only 1.01% per year. Since we do not know whether future growth will follow the average of the last 40 years or that of the last 20, both possibilities have been contemplated. In the medium economic growth scenario, the average annual income growth per adult is 1.58%, while in the weak growth scenario it is 1%. The hypothesis of a weak per adult GDP growth is deemed more plausible, the "Glorious Thirties" probably constituting a time-related event with little chance of being repeated in the future.

Table 6:
Description of the Scenarios

Δ%GDP/ Adult	Demographic Growth	Name of Scenario	Scenario Number
1.00%	Weak	Low-weak	1
1.00%	Average	Low-average	2
1.00%	Strong	Low-strong	3
1.58%	Weak	Average-weak	4
1.58%	Average	Average-average	5
1.58%	Strong	Average-strong	6

Figure 23:
Price Projections



The combination of the three demographic growth hypotheses and two economic growth scenarios form six scenarios described in Table 6. In the first, called low-weak, economic growth is 1% per year and the population experiences weak growth. In the low-average scenario, economic growth is still 1% per year while the population follows the average scenario of Statistics Canada. The low-strong scenario for its part combines weak real GDP growth with strong population growth. The average-weak, average-average and average-strong use the same economic growth assumptions but combine them with a 1.58% growth in real GDP per adult.

7.2.2 Real Price Projections for Canada

The Canadian model forecasts for the 1998-2016 period are presented in the grey section of Figure 23. The data are available in an appendix.[65] The principal elements of these projections are the following.

First of all, the model confirms that due to the co-integration relation, the price trend is conditioned by that of income. Consequently, in the scenarios numbered 4, 5 and 6, the price increases more rapidly than in scenarios 1, 2 and 3. Hence, if real income grows by 1.58% per year, the real price in 2016 would range between a minimum value of $150,290 and a maximum of $163,962. On the other hand, if we assume that income will grow by only 1% per year in the future, the price will range between $115,627 (low-weak) and $126,145 (low-strong). Since the real price for 1997 is $113,593, the model therefore allows for anticipating that the real price in 2016 will be between 1.8%

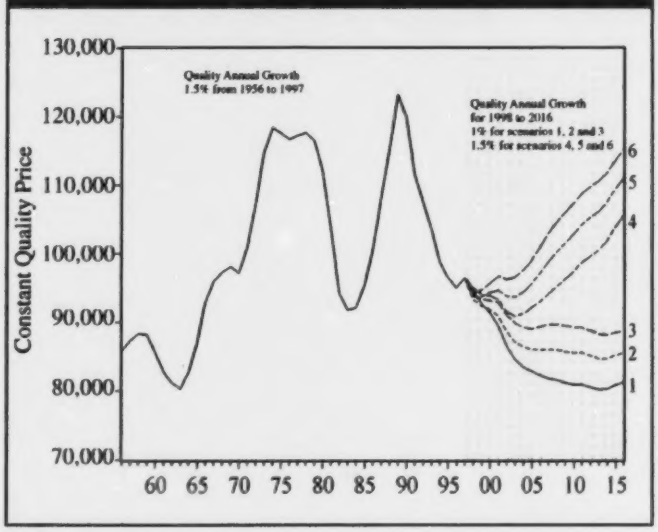
and 44.3% higher than that of 1997. Even the most pessimistic scenarios therefore allow for anticipating that the real price in 2016 will not be lower than in 1997. We point out that the uncertainty about the price stems above all from that of the income growth projections. In fact, the price discrepancy is only 9% by the year 2016 between the weak and strong demographic growth scenarios, while that between the weak and average income growth is approximately 30%.

On the other hand, even if the model does not project that the price in 2016 is lower than that of 1997, it allows for anticipating downward pressures on the prices in the first half of the next decade due to demographic changes. These pressures are enough in the low-weak and low-average scenarios for the real price in the middle of the next decade to be lower than that of 1997. The lowest projected value is in 2004 in the low-weak scenario, with a price of only $105,325, which is 7.3% lower than the 1997 price. The price recovers, however, in the next ten years.

Furthermore, section 3.2.1 allowed the conclusions that the real MLS price probably has a bias that overestimates the price growth of constant quality housing. The comparison of different price measurements would suggest that the average annual improvement in quality was 1.5%. This gradual qualitative housing improvement appears to be the result of the underlying growth in real income. Since the model is estimated on biased real prices, its projections also have a bias. This can be estimated at 1.5% per year if real income grows at the same rate as during the 1956-1997 period. Hence, in the scenarios where real income increases by 1.58% per year, the projected real price would comprise an average annual qualitative improvement of 1.5% per year. On the other hand, if we assume that real income will grow only 1% per year, the quality of housing will increase less rapidly in the future than it has historically. It is speculative to presume what would then be the average quality increase. If we assume that the growth in quality is proportional to that of real income, the bias in scenarios 1, 2 and 3 would then be only 1% per year.

Figure 24 shows the price adjusted for quality and standardized in relation to the 1986 price. The quality improvement between 1986 and 1997 reduces the 1997 real price by 17.8% so that the 1997 constant quality price is only $96,432 instead of $113,952. In the average income growth scenarios, the real constant quality price in 2004 would then range between $91,190 and $97,538. If we assume low income growth, the 2004 constant quality price would be between $83,397 and $89,243. For the next five years, the model therefore allows for anticipating at best stagnation in the real constant quality price and perhaps a decline capable of reaching 13.5% between now and 2004. By 2016, however, the real price will range between $105,608 and $115,248 in the average income growth scenarios, thereby showing a progression in the constant quality price between 2004 and 2016. Conversely, if we assume weak growth in real income, the adjusted price would continue to decline during this period to bring it to between $81,250 and $88,680.

Figure 24:
Constant Quality Price Projections



In summary, the average housing sales price, expressed in constant 1986 dollars, should at worst remain at about the same level as in 1997, and at best, increase by close to 30% in the course of the next twenty years. During the next five years, demographic pressures will, however, contribute to lowering the real price, which could temporarily reduce the real price insignificantly. On the other hand, if we consider that the average quality of housing will probably continue to grow, the real constant quality price stands a good chance of decreasing between now and 2016, the decrease potentially reaching 15.6% if the low demographic growth scenario is combined with slow growth in real income.

7.2.3 Real Price Forecasts for the Provinces

The provincial projections differ from the Canadian projections for three reasons. The first is the difference in their future demographic evolution. The second comes from the differences in the provincial economic conditions. Lastly, the third is that the estimated models do not have the same coefficients. We have already presented the provincial models. Here we present the provincial differences in the average demographic forecast scenario. By concentrating on this scenario, we avoid the fastidious process of repeating a similar exercise for the weak and strong scenarios that present basically the same provincial differences. Attention will also focus on the recent economic evolution in the provinces.

All of the provinces will experience slower demographic growth in the next twenty years than during the period from 1956 to 1997. Three provinces, namely Ontario, British Columbia and Alberta will experience greater demographic vitality than the Canadian average while the situation will be reversed for the Atlantic Provinces, Quebec, Manitoba and Saskatchewan. The average scenario allows for anticipating that the Atlantic Provinces will suffer a decline in the population aged 25-54 from 2002 onwards. This region's demographic decline will accelerate continuously so that after 2012, this population will decrease by more than 1% per year. These provinces are followed on the path to decline by Saskatchewan, which will see its population aged 25-54 remain stable between 2002 and 2006 to then begin to decline. The population growth rate will decrease more slowly in Quebec and it is not until 2008 that the population in the same age group will begin to decrease. Manitoba will suffer a significant slowing in growth in 2002 but will maintain positive population growth until 2008, the decline beginning in 2009, or one year later than in Quebec.

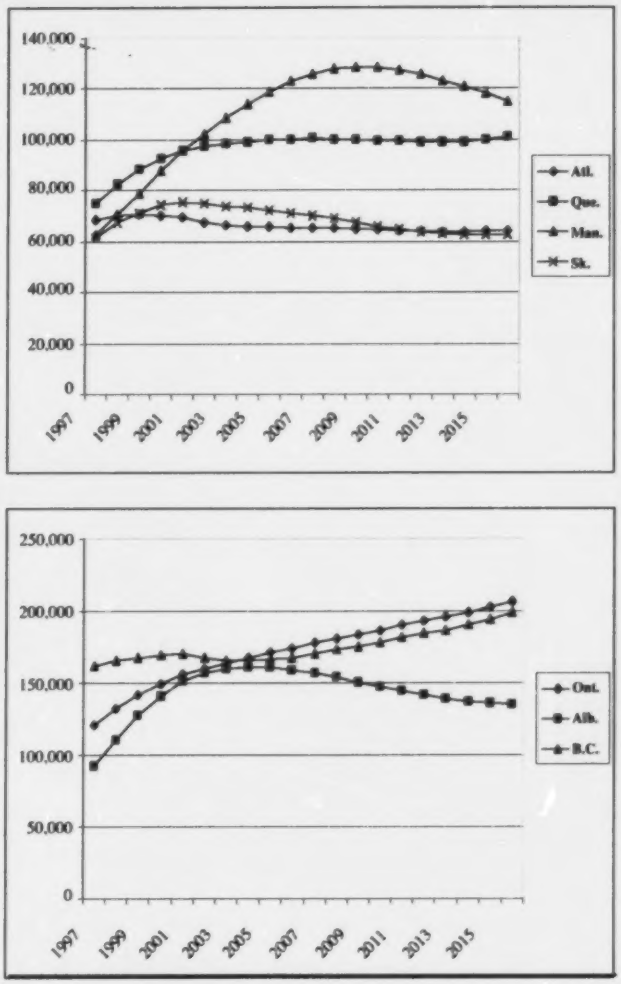
It is British Columbia that will have the most rapid population growth until 2001, i.e. between 1.5% and 2% per year. From 2002, the growth rate declines rapidly to find itself at approximately 1% until 2005 before slowing slightly thereafter. A less pronounced slow-down in Ontario will allow this province to experience more rapid growth than British Columbia after 2005, both provinces having an identical 1.06% growth rate in 2004. Alberta will follow a demographic evolution modelled on that of British Columbia, but with approximately one half of a percentage point lower growth rate per year. These three provinces will still experience positive growth in 2016.[66]

The behaviour of the prices in the coming years also depends on the recent shocks on real income. The strongest shocks occurred in Saskatchewan and Manitoba, which have both experienced exceptional growth in real income per capita since 1994. It has in fact experienced a cumulative increase of more than 9% in three years in these two provinces. Alberta profited from a 5% increase in real income in 1997. Quebec, Ontario and the Atlantic Provinces benefited in 1997 from a normal increase in real income after it had stagnated or declined for the major part of the decade. Lastly, British Columbia recently experienced weak growth in real income per capita.

Figure 25 shows the real price projections by province for the low-average scenario, namely, the one in which real income growth is 1% and demographic growth is average. The upper part of the figure presents the provinces with weak demographic growth, while the lower figure shows the price for the provinces with strong demographic vitality.

Generally speaking, the provincial models project stronger real price growth than the Canadian model. All of the provinces should experience real price growth until 2000. However, the increase will be very weak in the Atlantic Provinces since they will then be set at $70,357 as compared with $68,227 in 1997. From 2001 onwards, the prices will begin to decrease in the Atlantic Provinces until they reach $63,926 in 2012, when they will thereafter remain fairly stable. The prices in Saskatchewan will also show a declining slope from 2003 after having reached a $75,480 peak in 2001. The decline will be more marked than in the Atlantic region so that in 2016, the prices will be no more than $62,383. The anticipated weakness in the growth of prices in these provinces comes from the low coefficient associated with income, the result of which is that income growth cannot compensate the deflationary impact of the population decrease.

Figure 25:
Price Projections by Province



The model forecasts that the prices in Quebec should experience a significant recovery in the course of the coming years, going from $74,754 in 1997 to $100,251 in 2007. Afterwards, the prices should remain relatively stable. Manitoba presents a peculiar situation. While the prices there are among the lowest in Canada, the model forecasts that they will experience strong growth over the course of the next ten years to reach $128,371 in 2009 before decreasing to $115,239. This strong price response stems from the shock on real income associated with the quasi-unitary price root in the system's second equation.

The three provinces with strong demographics, namely Ontario, British Columbia and Alberta, should all experience a fairly significant growth in prices. The model forecasts an especially marked rise in Ontario and in Alberta. The upward price trend in Ontario stems in large part from the strong estimated income coefficient, which would take the real price to more than $200,000 in 2016. If, as suspected, the income coefficient is overestimated in this province, the price increase there will be lower than that projected by the model. The prices in Alberta will reach a peak of $160,679 in 2004, as a reaction to the large real income growth recently observed. These prices should, however, decrease somewhat to return to $135,190 in 2016. Lastly, the prices in British Columbia will not change much until 2005, staying at approximately $165,000, but should then resume an upward trend that would take them to just below the $200,000 level in 2016.

It is stressed that these projections are not compatible with the national projections. This can be explained in two ways. First of all, the dependent variable in the national equation is the price weighted by the transactions, which, for reasons discussed in section 3.2.1, is not comparable to a provincial price average. But above all, the parameters of the provincial models differ from those of the Canadian model. They nevertheless allow regional trends to be identified and indicate in which regions of the country the downward pressures from the demographic changes will be the strongest. Clearly, the regions most at risk are the Atlantic Provinces and Saskatchewan, which will be the first to experience a population decline. In Quebec and in Manitoba, income growth should be enough to compensate the demographic pressures. Lastly, in the three provinces with strong demographics, the income effect should dominate that of the demographics to continue to push real prices upwards.

Finally, it is important to recall that the projections are based on a stable growth in real income. Historically, economic fluctuations have always been observed. The model forecasts quite a strong price reaction to these fluctuations. Similarly, the interest rates cause quite a marked reaction in the real price. It is therefore necessary to expect the real housing price to continue to undergo marked fluctuations that will result in the price deviating from the projections. Random economic conditions will determine at what times and in what locations they occur.

8. CONCLUSION

Demographic changes constitute one of the most important forces shaping the evolution of the housing market. Since the rate of young household formation has slowed down, the demand for new housing is weaker than at the time when the baby boomers were just beginning their working life. At the same time, the aging of the baby-boom generation increases the number of dwellings for sale. We studied whether this would be sufficient to trigger a pronounced downward trend in residential real estate prices.

The problem was approached by recalling that the price is determined by supply and demand conditions and that the supply adjusts when the housing price is abnormally high. The price movements therefore tend to be dissipated over the longer term when the housing stock has been able to adjust. Then two types of changes that have affected the real housing price in Canada over the past 40 years were documented. First of all, the prices experienced two periods of large increases, namely, during the periods of 1973-75 and 1985-89, and two episodes of sharp decreases, namely, 1980-82 and 1990-92. Afterwards, the average real housing sales price experienced quite a pronounced upward trend. This upward trend seems to be the result of a qualitative housing improvement because some price indices that correct for quality improvement do not show an underlying increase.

To understand the factors likely to explain such price fluctuations, the demographic and economic evolution were studied, focussing on real income and residential mortgage interest rates. These factors' contribution was evaluated in two ways. First of all, the existing literature was summarized to establish, if possible, a consensus on the importance of demographics in determining real prices. This overview led in fact to the observation of the absence of consensus on a critical point. It is not known whether the housing demand increases or decreases with age beyond 40 years. It is consequently impossible to establish whether the aging of the baby-boom generation will cause the housing demand to decrease.

In spite of the lack of consensus, it should be noted that one solitary scientific study was unearthed, that by Mankiw and Weil (1989), which concludes that demographics could make the real estate market collapse. The other studies systematically conclude either that there will be no effect or, instead, that it will be temporary and of little importance, or yet again that it will be counterbalanced by the increase in real income. Only two studies, namely that by Laycock (1979) and that by Engelhardt and Poterba (1991), studied the impact of demographics on Canadian historical data. Both conclude that the effect on the housing price is not statistically significant. On the other hand, the fluctuations in real income and interest rates were important.

The scientific conclusions are not repeated in the popular press and general public literature. The Foot and Stoffmann (1996) contention is, on the contrary, that population aging can cause real estate prices to collapse. When the baby boomers want to sell their dwellings all at the same time, the next generation will be too small in numbers to buy them. This will not allow for maintaining the prices, which will have to decrease to balance the market. This contention was widely echoed in magazines and newspapers but met a cool, even negative reception from housing market analysts. The latter, and especially Clayton, recalled the importance of economic factors in determining prices.

To clarify the respective contribution of these two types of influences, we estimated, using Canadian data, a structural model of the housing market that proved to be stable over the 1956-1997 period. The model contains a demand equation and a housing stock adjustment equation. This latter equation shows that two variables are important in new housing construction activity, namely the housing price and the GDP growth per capita. It was also shown that the real price is co-integrated with real per capita income, which implies that the price trend is common to that of income. Furthermore, the price equation clarifies the

contribution of the demographic and economic shocks to the historical fluctuations of the real housing price.

The model shows that of the various possible demographic measurements, only the growth in the population aged 25-54 has a statistically significant impact on the real housing price. The passage of the baby-boom generation raised the real price by 25% between 1965 and 1975, the level at which it stayed until 1989. It then decreased 20% between 1989 and 1997 when a smaller generation followed. The demographic impact was therefore considerable. The economic fluctuations, and in particular the 1980-82 recession and the economic decline of the '90s in the meantime had an even greater influence. In fact, the acceleration in real income growth from 1963 to the end of the '70s was such that the real housing price in 1979 surpassed by 36% the value it would have had if economic growth had been evenly distributed across all of the years. However, the poor Canadian economic performance reduced the real price by 31% between 1989 and 1997.

Finally, the model was used to simulate the price evolution based on various demographic growth scenarios projected by Statistics Canada and two real income growth hypotheses. The projections show that the real housing price is not likely to decrease in Canada over the course of the coming years. The greatest part of the downward demographic pressures occurred during the '90s. What remains to be absorbed will occur mostly between 2002 and 2005 when the growth of the population aged 25-54 will slow more rapidly. However, the upward trend resulting from the increase in real income will in all plausibility dominate the demographic impact, especially after 2005. On the other hand, we recalled that if a correction is made for the probable quality bias, the contention of the underlying real price decrease becomes plausible in the weak economic growth scenario.

The structure of the provincial models was similar to that of the Canadian model. However, certain important coefficients vary from one province to another. It was especially stressed that the effect of income on price seemed greater in Ontario and particularly weak in the Atlantic Provinces. Furthermore, Manitoba stands out because the price is quasi non-stationary, which implies a very slow and important price reaction dynamic. The simulations reveal that in the Atlantic Provinces and Saskatchewan, it is probable that prices will decline. This will occur because the population aged 25-54 will begin to decline earlier than in the other provinces and the reduction will be sharper. However, by 2016, the model forecasts moderate decreases that will barely surpass 10% as compared with current prices. In all of the other provinces, a real price which is higher than at present is projected. The price growth will be especially large in the provinces with more vital demographic growth, namely Ontario, Alberta and British Columbia. Ontario, which will experience more sustained demographic growth than the other provinces, should benefit from the strongest price increase.

We conclude that even if it is true that demographics will tend to reduce real estate prices, its impact will probably be dominant only in the Atlantic region and Saskatchewan. In the other regions, the real price should have a tendency to rise. To avoid a property price decline, the Atlantic region and Saskatchewan will have to experience more rapid real income growth per capita or other decreases in interest rates.

Before coming to a definitive conclusion, there remain some important aspects to study. First of all, this study did not allow for directly clarifying whether aging increases or decreases the housing demand. This study, having associated the demand changes with population changes in the group aged 25-54, indicates that the size variation in age groups over 55 would have no effect on the demand. Indirectly, this can be interpreted as a sign that the housing demand is stable after age 55. However, it would be useful if the age effect on the housing demand could be better defined, especially in the over-40 age segment.
Secondly, Canadian data still suffer from the absence of constant quality price indices. The average MLS transaction prices then assume great importance provided that the quality bias they contain is accurately identified.

Lastly, it would be useful to pursue the work on the relation between the population growth rate and the rate of new housing construction activity. The absence of co-integration between the number of dwellings and the population was observed, which was interpreted as a result of lasting shocks on the household headship rate. This raises the question of the endogenous or exogenous long-term character of this headship rate. If it is exogenous, it then becomes possible to further constrain the relation between the variations in population growth rate and the rate of construction. This would allow for a better understanding of the housing market's adjustment mechanisms, and thus, of long-term price determination.

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ENDNOTES

1 Markets are complete when transactions are possible for all the goods and services. In the case of the housing market, the two main sources of incomplete markets are the absence of a long-term single-dwelling rental market and the mortgage credit development delays that were observed until the end of the 60's.

2 For example, municipal taxes are proportionate to the assessment roll, which itself is based on the building's market value. However, not all of the expenses are in proportion to the value. For example, certain taxes are fixed amounts per dwelling while the electricity bill contains a daily charge separate from consumption.

3 This expression is obtained by differentiating equation 1 in relation to the inflation rate B under the hypotheses that $di/d\pi = d(\Delta P/P)/d\pi = 1$.

4 For a Canadian estimate of the different household characteristics that influence the housing demand, we can refer to Steele (1979).

5 If productivity per hectare increases through more intensive use of fertilizers, the price of land will decrease even if the real price of food does not go down. This would occur because agricultural production would make less intensive use of the land.

6 The gradual price adjustment hypothesis implies that future variations in the housing price are in part predictable. This opens the possibility of making real estate transactions for reaping an abnormal profit. Only high transaction costs could prevent such transactions from being abnormally profitable.

7 In equation 4,$C_t(W_t, P_t)$ can also be seen as a partial adjustment towards the desired housing stock, or $C_t(W_t, P_t) = \alpha[L^1 - L^0]$. When long-term equilibrium is reached, the housing activity only just allows replacing the physical depreciation in the housing.

8 Cansim No. D20588

9 In theory, two types of causalities occur. When housing demand varies, changes in housing prices have repercussions on the derived inputs demand. The causality then moves from the housing price to that of the resources. When, on the other hand, resource prices experience exogenous changes, for example after hurricane Andrew, it is the building cost that influences the housing price.

10 While the Laspeyres index chooses constant quantities to calculate price change, the Paasche index uses current quantities instead. The Fisher index is the geometric mean of the two.

11 Laycock, W., "Housing Prices of the Seventies: Perspectives and Analysis", Study No. 78.05, Economic Research Directorate, Anti-Inflation Board, 1978, p. 4.

12 We used the Statistics Canada data to find out the estimated number of dwellings in each province.

13 For example, assume that the average profit margin is initially situated at 25% of the sales price. To produce a 20% reduction in the sales price in relation to building costs, the profit margin must decrease to 5% of the sales price, or an 80% drop in profits. If the margin were initially 20%, the profits would have to disappear completely in order for the real price to drop 20% in relation to the costs.

14 The estimated equation is NHPI = -69.47(7.43) + 1.296(0.99)*CCI+ 0.549(.092)*CCI (-1) -0.479(.070)*TREND, where the values in parentheses are the estimated standard deviations of the coefficients. The trend therefore has great statistical significance. Since the sum of the coefficients associated with CCI and CCI(-1) is higher than one, this implies that there is greater volatility in the sales price than in the building cost. Therefore the profits react strongly to short-term changes in the sales price.

15 The correlations between the MLS, NHPI, NBSA and CCI series calculated for the 1972-1997 period do not differ from those calculated for the 1972-1985 period.

16 If demand remains relatively constant for the majority of working life and declines only at retirement, it will then be influenced primarily by the size of the working age population. In practice, however, the weight of senior citizens in the total adult population has historically been fairly light so that the population aged 25 and over has evolved similarly to the population aged 25 to 64.

17 See for example, Lewis, R. (1987), *The Long-term Housing Outlook: Household Growth in Canada and the Provinces*, 1991-2016, Canada Mortgage and Housing Corporation, Ottawa.

18 Inter alia, see Levin, E.J. and R.E. Wright (1997), "The impact of speculation on house prices in the United Kingdom", Economic Modelling 14, 567-585.

19 As previously stressed, the Construction Costs Index is positively correlated with housing activity, which suggests that it reacts more to the housing demand than to changes in the supply factors. The possibility of using the land component of the New Housing Price Index was studied. In this case too, the correlation with housing activity was positive, posing the same problem as the Construction Costs Index.

20 It is believed that high real price in Quebec can be explained by the relatively large number of multiple-unit residential buildings (duplex and triplex) in the Montreal region. Unfortunately, the Canadian Real Estate Association data does not allow verifying or rejecting this interpretation.

21 This weakness is moreover highlighted by Lanoie (1997).

22 Foot gave several interviews to journalists to promote his book. Essentially uncritical, these texts only present the author's arguments. See for example, the texts by Auger (1996), Ducas (1996), Giroux (1996) and Lortie (1996).

23 Laycock, W., *Housing Prices of the Seventies: Perspectives and Analysis*, Study No. 78.05, Economic Research Directorate, Anti-Inflation Board, Ottawa, 1978.

24 Laycock, W., op. cit., p. 48-49.

25 By establishing that an increase of one percentage point in the inflation rate accelerates the growth rate of housing prices by one percentage point, Haycock assumes that the real housing price is insensitive to the level of the prices.

26 Mankiw and Weil, op. cit., p. 248.

27 For tenant households, the census indicates the monthly rent but does not provide the value of the dwelling occupied. They circumvent the difficulty by assuming that the value of the dwelling is equal to 100 times the monthly rent.

28 Mankiw et Weil, op. cit., p. 239.

29 Woodward, S. (1991), Economists' prejudices: Why the Mankiw-Weil story is not credible, Regional Science and Urban Economics 21, 531-537.

30 Such a result is not surprising. The effect of mortgage interest deductibility in the United States is that it lowers the real housing services costs for households with lower equity. It is therefore before age forty that mortgage interest deductibility favours residential ownership. When Canadian households are in a position to pay off their mortgage, usually in their forties, the cost disadvantage with the United States disappears and they are capable of meeting the housing consumption profile observed in the United States.

31 In its simplest form, Hamilton's argument can be summarized as follows. At given supply conditions, a highly populated generation raises the competition for housing, which causes the housing price to rise. The purpose of the rise in price is to balance the market by reducing the real quantity of housing each household consumes. Yet, we observed an increased consumption by the highly populated generation, which contradicts the effect the price increase should have caused.

32 Co-integration is also important when non-stationary variables are regressed. In fact, when the variables are co-integrated, the least-squares estimators converge asymptotically and the spurious correlations cannot emerge.

33 Holland, A. S. (1991), "The Baby Boom and the Housing Market: Another look at the evidence", Regional Science and Urban Economics 21, 565-571.

34 Mankiw, N. G. et D. N. Weil (1992), The baby boom, the baby bust and the housing market: A reply to our critics, Regional Science and Urban Economics 21, 573-579.

35 His study does not enable clarification of the meaning of the relation's causality. Hence, it might very well be that it is the rise in the housing price that causes the building costs to increase at the local level.

36 Swan raises furthermore, that the MW variable requires a correction. The real housing value is obtained by taking the value of the dwelling as estimated by the household at the time it is surveyed. This value necessarily includes the structures and the land. On the other hand, to obtain a real value, MW then divide by the housing activity deflator, which excludes the price of the land. In an appendix, Swan develops a mechanism that corrects a major part of this problem. He stresses, however, that this correction has very little impact on the results.

37 The authors of this document observed that the correlation between housing starts and the change in the real housing activity cost is 0.50 in Canada. The changes in material prices in Canada therefore seem to react above all to the changes in housing demand.

38 Pitkin, J.R. and W. Myers (1994), "The Specification of Demographic Effects on Housing Demand: Avoiding the Age-Cohort Fallacy", Journal of Housing Economics 3, p. 248. The italicized emphasis is found in the original document.

39 According to their 1980 sample, less than one person in four in the group aged 40-44 had not completed high school education, while more than half the people over age 65 were in this group.

40 It is important to grasp that this is not just a matter of a gradual adjustment of the housing stock towards equilibrium. In their model, it is only the price itself that adjusts gradually towards equilibrium.

41 This is in fact an equation similar to equation 4 in section 2.2.

42 DiPasquale and Wheaton do, however, point out that the time required for selling is a very important variable in the equation. Its strength is such that it cannot be explained only by the variations in the financing cost. In all plausibility, it also captures some conjunctural elements. This gives weight to the fact that as the price adjusts slowly, it is not an adequate variable for measuring the effect on housing starts. It is mentioned that in an earlier article (DiPasquale and Wheaton, 1992), they had estimated a significant effect for the vacancy rate on the building of new rental housing. The vacancy rate at that point played a role similar to that held by the selling time.

43 DiPasquale, D. and W.C. Wheaton (1994), "Housing Market Dynamics and the Future of Housing Prices", *Journal of Urban Economics* 35, 24.

44 In a vectoral system, the error correction representation contains all of the lagged-difference endogenous variables, as well as a stable linear combination of the level of the variables. The co-integration relation is what produces this stable combination which we call error correction.

45 They point out that since the price changes can be forecasted by their equation, this leads to believing that the efficient market hypothesis cannot be applied to housing.

46 Fair, R.C. and K.M. Dominguez (1991), "Effects of the Changing U.S. Age Distribution on Macroeconomics Equations", *American Economic Review* 81(5), note 13, p. 1286.

47 Disequilibrium is the term employed to designate the residual of the co-integration relation. In their case, this residual is measured by standardizing in relation to the real price, therefore by calculating $\log(p) - 0.14 \times \log(y)$, where p is the real housing price and y is real income. In an error correction model, this disequilibrium is likely to influence the change in the price. The coefficient measuring the impact of the disequilibrium on the price change constitutes one measurement of the speed at which the price returns to its equilibrium value.

48 Holly and Jones do not suggest explanations for this observation. We allow ourselves to suggest that this is compatible with a situation in which, when there is a demand surplus, the adjustment usually consists of ceasing building without actually destroying the existing stock. On the other hand, in the case of surplus demand, the rate of housing activity can be accelerated when the disequilibrium is very great.

49 This cross-Canada data is found in CANSIM matrix 4079, while the provincial estimates are in matrices 4080 to 4089 for the ten provinces.

50 More specifically, it is possible to find some formulations in which construction is linked to growth in the adult population, which links the housing stock to the adult population. However, those that produce this result are incomplete specifications in which the real housing price is omitted from the housing starts equation. When a correctly specified model is considered, the demographic variables are not significant in the housing starts equation.

51 See Granger and Newbold (1974).

52 Granger and Newbold (1974) showed that the spurious correlation occurs between non-stationary independent series. When the stochastic shocks are common, the two series are dependent, thus eliminating the problem.

53 The intuitive reason for which the lagged dependent variable eliminates the problem of fictitious correlation is that the first-difference model becomes a simple rewriting of the level model.

54 We verified moreover, still with the ADF test, that the logarithmic change of the real price is stationary.

55 The Johansen plausibility ratio test performed with a lag to capture the short-term dynamics has a calculated value of 15.85 as opposed to a critical value of 15.41 at 5%. The hypothesis of absence of co-integration relation is rejected. The estimated co-integration relation is P_t - 1.058 x Y_t - 8.166. The ADF test applied to this relation confirms that it is a stationary series.

56 The calculated value is -1.142 while the MacKinnon critical value is -2.935. On the other hand, the variation of the housing stock rate of change is stationary.

57 The standardized co-integration relation compared with the stock change is ΔS_t - 1.123 x ΔY_t - 0.006.

58 Equation 7 is thus overidentified while equation 8 is only barely identified.

59 See Greene (1990), p. 629 for a discussion of autocorrelation in the variable instrument models and p. 632 for a presentation of the advantages of the three-step least squares estimator.

60 The marginal value of the joint hypotheses test is fairly close to the level of 5%, leading to the rejection of the null hypothesis and it is legitimate to ask whether we are perhaps making a mistake in excluding certain variables. It is the nullity of TUC in the ΔS equation that makes rejecting the test more difficult. In fact, if we did not impose the nullity of β_4 at the same time as the other hypotheses, the χ^2 would only be 9.046 and the test's marginal value would only barely reach 0.34. On the other hand, if we keep TUC in the equation and exclude the other variables, the estimate period is extended by 5 years to start in 1958. With this longer sample, β_4 therefore has a marginal significance level of only 0.25. We can therefore remove it from the final specification.

61 The scenario selected consists of assuming that the rate of growth of real income per capita and that of the population are 1%, while the mortgage interest rate is 7.5%. These values are not important because the percentage deviations in relation to the scenario remain identical regardless of what values are chosen. What is important, however, is that the income and population growth rates are constant.

62 The reader is invited to refer to Figure 15 to visualize the housing activity level changes in this province. The seemingly erratic movements in the housing stock variation made us suspect possible data errors. However, an audit did not enable such errors to be detected.

63 The impact of a permanent 1% increase in interest rates is a long-term 2.46% reduction in the real housing price.

64 Canada. Statistics Canada (1994), *Population projections for Canada*, provinces and territories, 1993-2016, 91-520, DISTC, Ottawa.

65 The set of projections is also contained in a spreadsheet attached to the report. This spreadsheet is designed so that a change of assumptions allows for modifying the model's projected values. The analyst can thus alter his or her assumptions so as to study the sensitivity of the projections.

66 The provincial population growth data are contained in the file appended to the report.

APPENDIX 1

HOUSING PRICE AND STOCK ADJUSTMENT TO A DEMOGRAPHIC SHOCK

The total differential of (6) is:

$$H_{Ni}dN_{it} + H_x dX_t + H_P dP_t + H_u dU_t = C_w dW_t + C_P dP_t - (1-\delta)dS_{t-1} \quad \text{(A1)}$$

By grouping the terms and isolating dPt to the left, we obtain:

$$dP_t = [H_{Ni}dN_{it} + H_x dX_t + H_u dU_t - C_w dW_t - (1-\delta)dS_{t-1}]/(C_P - H_P) \quad \text{(A2)}$$

Since C_P is positive when H_P is negative, the partial effects of the variables on the real price are, generally speaking, without ambiguity. The instantaneous effect on the price of a change in the size of demographic group i is obtained by assuming that only dN_{it} is not null, which gives:

$$dP_t / dN_{it} = H_{Ni}/(C_P - H_P) > 0 \quad \text{(A3)}$$

For its part, the housing stock reaction is obtained by differentiating (5') as compared to N_{it}. By the chain differentiation rule we then have:

$$dS_t / dN_{it} = (dS_t/dP_t) \text{ x } (dP_t / dN_{it}) = C_P \text{ x } H_{Ni}/(C_P - H_P) > 0 \quad \text{(A4)}$$

Hence, the housing stock in period t will be higher. The impact on the price at date $t+1$ is given by:

$$dP_{t+1} / dN_{it} = (dP_{t+1} / dN_{it+1}) \text{ x } (dN_{it+1}/dN_{it}) + (dP_{t+1} / dS_t) \text{ x } (dS_t / dN_{it}) \quad \text{(A5)}$$

Equation A5 has two terms. The first indicates the impact on the price by the part of the population increase that is still present in the following period. The second term is the effect on the price of the growth in the housing stock. For simplification, we assume that the growth in N_{it+1} is permanent, i.e., $dN_{it+1}/dN_{it} = 1$. The effect on P_{t+1} can then be written as follows.

$$dP_{t+1} / dN_{it} = H_{Ni}/(C_P - H_P) - [(1-\delta)C_P/(C_P - H_P)] \text{ x } H_{Ni}/(C_P - H_P) \quad \text{(A6)}$$

By factorizing $H_{ni}/(C_P - H_P)$ we obtain:

$$dP_{t+1} / dN_{it} = [H_{Ni}/(C_P - H_P)] \text{ x } [1 - (1-\delta)C_P/(C_P - H_P)] \quad \text{(A7)}$$

Hence, the effect on the price at date $t+1$ is weaker than at date t. As for the effect on S_{t+1}, it is given by:

$$dS_{t+1} / dN_{it} = (dS_{t+1} / dS_t) \text{ x } (dS_t/dN_{it}) + (dS_{t+1} / dP_{t+1}) \text{ x } (dP_{t+1}/dN_{it}) \quad \text{(A8)}$$

The first part of this equation indicates the fraction of the capital stock built during period t that is still in place in period $t+1$, while the second part of the equation represents the capital that is built at date $t+1$ because the real price at this date is high. By substituting the appropriate values in the different elements of this equation, we find:

$$dS_{t+1} / dN_{it} = C_P \text{ x } H_{ni}/(C_P - H_P)[1 + (1-\delta)(1- C_P/(C_P - H_P))] > dS_t / dN_{it} \quad \text{(A9)}$$

Hence, the housing stock at date $t+2$ is higher than in period $t+1$. We stress that the housing stock adjustment speed is represented by C_P. If it assumes a high value, the stock reacts more strongly to the change in the housing price, as we see in equations A4 and A9. The more rapid effect of the housing stock adjustment is to limit the price increase, both at the time of impact as shown by equation A3 and during the later periods as we see in equation A7.

APPENDIX 2

PROJECTIONS FOR THE 1998-2016 PERIOD

Table 7:
Real Price Projections

YEARS	LOW-WEAK	LOW-AVERAGE	LOW-STRONG	AVERAGE-WEAK	AVERAGE-AVERAGE	AVERAGE-STRONG
1997	113,593	113,593	113,593	113,593	113,593	113,593
1998	112,333	113,194	113,873	112,939	113,804	114,487
1999	111,262	112,763	113,955	112,912	114,435	115,645
2000	110,922	112,893	114,468	113,947	115,972	117,590
2001	109,626	112,490	114,915	114,223	117,207	119,733
2002	107,067	110,539	113,550	113,295	116,969	120,154
2003	105,680	109,581	113,006	113,655	117,851	121,534
2004	105,324	109,525	113,238	115,166	119,760	123,820
2005	105,739	110,141	114,043	117,560	122,454	126,793
2006	105,966	111,025	115,406	119,770	125,488	130,440
2007	106,547	112,082	116,794	122,389	128,747	134,160
2008	107,196	113,058	117,976	125,088	131,928	137,667
2009	107,768	113,836	118,858	127,688	134,878	140,828
2010	108,464	114,651	119,703	130,420	137,859	143,934
2011	109,557	115,802	120,834	133,618	141,235	147,372
2012	110,157	116,403	121,368	136,201	143,923	150,063
2013	110,784	116,999	121,873	138,793	146,579	152,684
2014	111,987	118,152	122,919	142,092	149,914	155,963
2015	113,843	119,938	124,582	146,229	154,058	160,023
2016	115,627	121,636	126,145	150,290	158,101	163,962

APPENDIX 3

DATA SOURCES

Price and quantity of housing sold through the Multiple Listing Service: *Canadian Real Estate Association,* special compilation.

New Housing Price Index: CANSIM, series P10248 for 1981-1997. This series was joined with the earlier data available from Statistics Canada for 1971-1981.

Residential Building Construction Price Index: CANSIM, series D20588

NHA home prices: *Housing Statistics*, Canada Mortgage and Housing Corporation, many issues.

Housing stock: Estimated year-end number of single- and multiple-unit dwellings, CANSIM, numbers D845803 (Canada), D845804 (Nfld.), D845807 (PEI), D845810 (NS), D845813 (NB), D845816 (Que.), D845819 (Ont.), D845822 (Man.), D845825 (Nfld.), D845828 (Alta.), D845831 (BC)

Home prices according to the National Balance Sheet Accounts: Estimated value of residential buildings, CANSIM, series D18882 divided by the estimated number of units D845803.

Canadian Real Gross Domestic Product: annual average from the CANSIM series D20463.

Provincial Real Gross Domestic Product: Conference Board of Canada for 1961-1995. For 1996-97, these series were joined with the real GDP estimates to the cost of the factors for the provinces, CANSIM series I340415 (Nlfd), I340530 (PEI), I340585 (NS), I340640 (NB), I340695 (Que.), I340750 (Ont.), I345475 (Man.), I345530 (Sask.), I345585 (Alta.), I345640 (BC).

Consumer Price Index: CANSIM, series P700000.

Five-year mortgage interest rate: CANSIM, series B14051.

Population of Canada and the provinces by age group, 1956-1970: Canada, Statistics Canada (1973), Population 1921-1971. *Revised annual population estimates by gender and age, Canada and provinces*, 91-512, [MIC], Ottawa.

[Population of Canada and the provinces by age group, 1971-1997]: CANSIM, matrices 6367 to 6377. (To connect the historical series on population, we estimated the 1971 population by applying to the 1970 population a rate of growth equal to the average growth rate observed in 1970 and 1972.)

[Population projections for Canada and the provinces by age group for different scenarios]: Canada, Statistics Canada (1994), *Population projections for Canada, provinces and territories, 1993-2016*, 91-520, DISTC, Ottawa.

APPENDIX 4

GUIDE TO USING THE PROJECTION FILES

The eight real price and housing stock projection files that accompany this document have been formatted in Microsoft Excel. These files were programmed so that the projection scenarios can be updated easily by modifying the value of the three exogenous variables that condition the model's behaviour: the five-year mortgage interest rate, the population growth between ages 25 and 54 and the growth in real income per capita. These variables are always placed in the same location on the sheets in the different files. Hence, the information on the interest rate is located in cell [E8], that on the real GDP in cell [E7] and that on population growth for the period from 1998 to 2016 in cells [I15..I33]. When any of this data is modified in the different scenarios, the model is automatically re-estimated. Furthermore, the figures displayed at the bottom of the first page of each file adjust to the changes in the scenario.

Table D-1
Housing Stock and Price Forecasts
Atlantic Provinces

[redacted]

Programming: Mario Fortin and André Leclerc

1998-2016

[redacted]

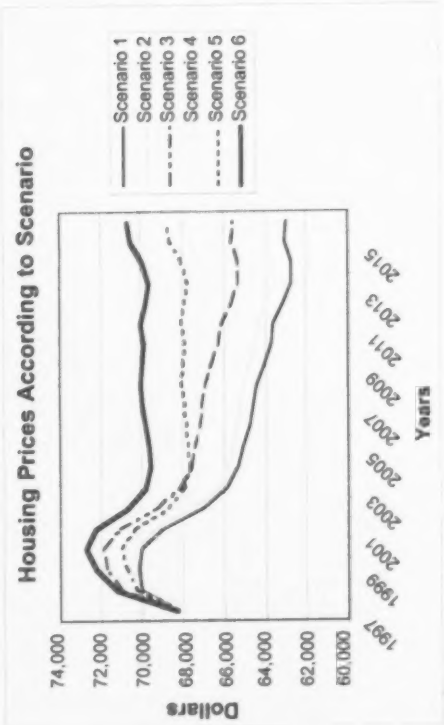
Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

1- GDP growth per adult = 1.00000
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 1 from Statistics Canada (weak growth)

	Forecasts		Price Equation												
1996		878765								13.68627					
1997	68227	888326	11.13060			16884		0.00701	13.68627	13.69709	0.01082	11.13060	13.68627	0.01	
1998	70002	899719	11.15629	11.13060	0.07500	17053	9.744072	0.00659	13.69709	13.70984	0.01274	11.15629	13.69709	0.01	0.733009
1999	70166	911662	11.15863	11.15629	0.07500	17223	9.754022	0.00403	13.70984	13.72302	0.01319	11.15863	13.70984	0.01	0.733009
2000	70028	923814	11.15665	11.15863	0.07500	17396	9.763973	0.00320	13.72302	13.73627	0.01324	11.15665	13.72302	0.01	0.733009
2001	68987	935430	11.14168	11.15665	0.07500	17570	9.773923	-0.00026	13.73627	13.74876	0.01250	11.14168	13.73627	0.01	0.733009
2002	67065	945760	11.11342	11.14168	0.07500	17745	9.783873	-0.00545	13.74876	13.75974	0.01098	11.11342	13.74876	0.01	0.733009
2003	65879	955254	11.09558	11.11342	0.07500	17923	9.793824	-0.00663	13.75974	13.76973	0.00999	11.09558	13.75974	0.01	0.733009
2004	65323	964337	11.08709	11.09558	0.07500	18102	9.803774	-0.00685	13.76973	13.77920	0.00946	11.08709	13.76973	0.01	0.733009
2005	65105	973235	11.08375	11.08709	0.07500	18283	9.813724	-0.00695	13.77920	13.78838	0.00919	11.08375	13.77920	0.01	0.733009
2006	64812	981866	11.07925	11.08375	0.07500	18466	9.823675	-0.00796	13.78838	13.79721	0.00883	11.07925	13.78838	0.01	0.733009
2007	64636	990303	11.07653	11.07925	0.07500	18650	9.833625	-0.00842	13.79721	13.80577	0.00856	11.07653	13.79721	0.01	0.733009
2008	64455	998527	11.07372	11.07653	0.07500	18837	9.843575	-0.00912	13.80577	13.81404	0.00827	11.07372	13.80577	0.01	0.733009
2009	64081	1006370	11.06791	11.07372	0.07500	19025	9.853526	-0.01056	13.81404	13.82186	0.00782	11.06791	13.81404	0.01	0.733009
2010	63744	1013852	11.06263	11.06791	0.07500	19216	9.863476	-0.01154	13.82186	13.82927	0.00741	11.06263	13.82186	0.01	0.733009
2011	63623	1021150	11.06074	11.06263	0.07500	19408	9.873426	-0.01180	13.82927	13.83644	0.00717	11.06074	13.82927	0.01	0.733009
2012	63133	1027943	11.05300	11.06074	0.07500	19602	9.883377	-0.01387	13.83644	13.84307	0.00663	11.05300	13.83644	0.01	0.733009
2013	62760	1034328	11.04708	11.05300	0.07500	19798	9.893327	-0.01486	13.84307	13.84926	0.00619	11.04708	13.84307	0.01	0.733009
2014	62781	1040647	11.04741	11.04708	0.07500	19996	9.903277	-0.01456	13.84926	13.85535	0.00609	11.04741	13.84926	0.01	0.733009
2015	63047	1047113	11.05163	11.04741	0.07500	20196	9.913228	-0.01408	13.85535	13.86155	0.00619	11.05163	13.85535	0.01	0.733009
2016	62967	1053420	11.05037	11.05163	0.07500	20398	9.923178	-0.01537	13.86155	13.86755	0.00601	11.05037	13.86155	0.01	0.733009

Table D-2
Housing Stock and Price Forecasts
Atlantic Provinces

Comparison of Results



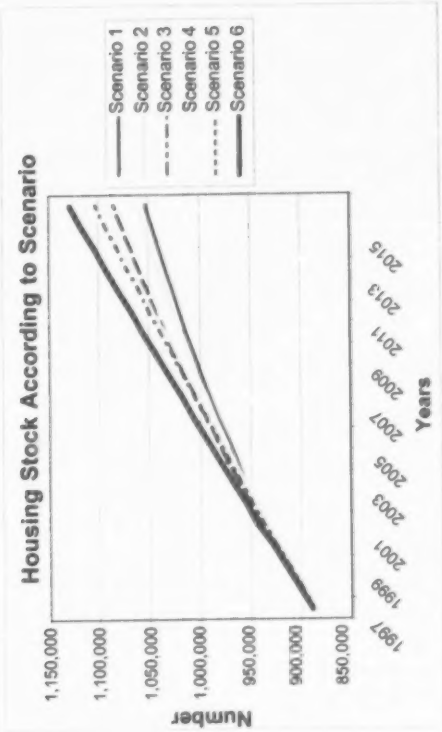


Table D-3
Housing Stock and Price Forecasts
Atlantic Provinces

Atlantic Provinces

1998-2016

Weak/Medium Scenario: Weak Economic Growth and Medium Demographic Growth

1- GDP growth per adult = 1.00000
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 2 from Statistics Canada (medium growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25,54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		878765								13.68627					
1997	68227	888326	11.13060			16884		0.00701	13.68627	13.69709	0.01082	11.13060	13.68627	0.01000	
1998	70124	899801	11.15801	11.13060	0.07500	17053	9.74407	0.00701	13.69709	13.70993	0.01283	11.15801	13.69709	0.01000	0.733009
1999	70357	911874	11.16133	11.15801	0.07500	17223	9.75402	0.00448	13.70993	13.72326	0.01333	11.16133	13.70993	0.01000	0.733009
2000	70262	924186	11.15999	11.16133	0.07500	17396	9.76397	0.00370	13.72326	13.73667	0.01341	11.15999	13.72326	0.01000	0.733009
2001	69309	936028	11.14632	11.15999	0.07500	17570	9.77392	0.00049	13.73667	13.74940	0.01273	11.14632	13.73667	0.01000	0.733009
2002	67435	946627	11.11892	11.14632	0.07500	17745	9.78387	-0.00463	13.74940	13.76066	0.01126	11.11892	13.74940	0.01000	0.733009
2003	66286	956422	11.10174	11.11892	0.07500	17923	9.79382	-0.00574	13.76066	13.77095	0.01029	11.10174	13.76066	0.01000	0.733009
2004	65759	965830	11.09375	11.10174	0.07500	18102	9.80377	-0.00589	13.77095	13.78074	0.00979	11.09375	13.77095	0.01000	0.733009
2005	65567	975076	11.09083	11.09375	0.07500	18283	9.81372	-0.00593	13.78074	13.79027	0.00953	11.09083	13.78074	0.01000	0.733009
2006	65359	984121	11.08766	11.09083	0.07500	18466	9.82367	-0.00665	13.79027	13.79950	0.00923	11.08766	13.79027	0.01000	0.733009
2007	65242	993019	11.08586	11.08766	0.07500	18650	9.83363	-0.00702	13.79950	13.80851	0.00900	11.08586	13.79950	0.01000	0.733009
2008	65105	1001740	11.08375	11.08586	0.07500	18837	9.84358	-0.00764	13.80851	13.81725	0.00874	11.08375	13.80851	0.01000	0.733009
2009	64771	1010112	11.07862	11.08375	0.07500	19025	9.85353	-0.00897	13.81725	13.82557	0.00832	11.07862	13.81725	0.01000	0.733009
2010	64470	1018153	11.07395	11.07862	0.07500	19216	9.86348	-0.00985	13.82557	13.83350	0.00793	11.07395	13.82557	0.01000	0.733009
2011	64383	1026034	11.07260	11.07395	0.07500	19408	9.87343	-0.01001	13.83350	13.84121	0.00771	11.07260	13.83350	0.01000	0.733009
2012	63926	1033439	11.06548	11.07260	0.07500	19602	9.88338	-0.01198	13.84121	13.84840	0.00719	11.06548	13.84121	0.01000	0.733009
2013	63584	1040461	11.06012	11.06548	0.07500	19798	9.89333	-0.01286	13.84840	13.85517	0.00677	11.06012	13.84840	0.01000	0.733009
2014	63639	1047441	11.06098	11.06012	0.07500	19996	9.90328	-0.01248	13.85517	13.86186	0.00669	11.06098	13.85517	0.01000	0.733009
2015	63934	1054586	11.06561	11.06098	0.07500	20196	9.91323	-0.01191	13.86186	13.86866	0.00680	11.06561	13.86186	0.01000	0.733009
2016	63886	1061596	11.06485	11.06561	0.07500	20398	9.92318	-0.01310	13.86866	13.87528	0.00662	11.06485	13.86866	0.01000	0.733009

Table D-4
Housing Stock and Price Forecasts
Atlantic Provinces

Atlantic Provinces

1998-2016

Weak Strong Scenario: Weak Economic Growth and Strong Demographic Growth

1- GDP growth per adult = 1.00000
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 3 from Statistics Canada (strong growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP rate for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25,54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	A(St)
1996		878765								13.68627					
1997	68227	888326	11.13060			16884		0.00701	13.68627	13.69709	0.01082	11.13060	13.68627	0.01	
1998	70993	900385	11.17034	11.13060	0.07500	17053	9.744072	0.00999	13.69709	13.71058	0.01348	11.17034	13.69709	0.01	0.733009
1999	71752	913398	11.18097	11.17034	0.07500	17223	9.754022	0.00782	13.71058	13.72493	0.01435	11.18097	13.71058	0.01	0.733009
2000	71916	926834	11.18326	11.18097	0.07500	17396	9.763973	0.00711	13.72493	13.73953	0.01460	11.18326	13.72493	0.01	0.733009
2001	71123	939934	11.17216	11.18326	0.07500	17570	9.773923	0.00416	13.73953	13.75357	0.01404	11.17216	13.73953	0.01	0.733009
2002	69284	951852	11.14596	11.17216	0.07500	17745	9.783873	-0.00089	13.75357	13.76617	0.01260	11.14596	13.75357	0.01	0.733009
2003	68144	962996	11.12938	11.14596	0.07500	17923	9.793824	-0.00192	13.76617	13.77780	0.01164	11.12938	13.76617	0.01	0.733009
2004	67613	973759	11.12155	11.12938	0.07500	18102	9.803774	-0.00203	13.77780	13.78892	0.01111	11.12155	13.77780	0.01	0.733009
2005	67416	984360	11.11864	11.12155	0.07500	18283	9.813724	-0.00201	13.78892	13.79975	0.01083	11.11864	13.78892	0.01	0.733009
2006	67234	994781	11.11593	11.11864	0.07500	18466	9.823675	-0.00253	13.79975	13.81028	0.01053	11.11593	13.79975	0.01	0.733009
2007	67126	1005063	11.11433	11.11593	0.07500	18650	9.833625	-0.00283	13.81028	13.82056	0.01028	11.11433	13.81028	0.01	0.733009
2008	66975	1015156	11.11207	11.11433	0.07500	18837	9.843575	-0.00344	13.82056	13.83055	0.00999	11.11207	13.82056	0.01	0.733009
2009	66619	1024883	11.10674	11.11207	0.07500	19025	9.853526	-0.00472	13.83055	13.84009	0.00954	11.10674	13.83055	0.01	0.733009
2010	66299	1034262	11.10193	11.10674	0.07500	19216	9.863476	-0.00555	13.84009	13.84920	0.00911	11.10193	13.84009	0.01	0.733009
2011	66187	1043456	11.10024	11.10193	0.07500	19408	9.873426	-0.00571	13.84920	13.85805	0.00885	11.10024	13.84920	0.01	0.733009
2012	65704	1052150	11.09292	11.10024	0.07500	19602	9.883377	-0.00761	13.85805	13.86635	0.00830	11.09292	13.85805	0.01	0.733009
2013	65344	1060439	11.08741	11.09292	0.07500	19798	9.893327	-0.00844	13.86635	13.87419	0.00785	11.08741	13.86635	0.01	0.733009
2014	65381	1068662	11.08798	11.08741	0.07500	19996	9.903277	-0.00805	13.87419	13.88192	0.00772	11.08798	13.87419	0.01	0.733009
2015	65662	1077029	11.09227	11.08798	0.07500	20196	9.913228	-0.00747	13.88192	13.88972	0.00780	11.09227	13.88192	0.01	0.733009
2016	65601	1085241	11.09135	11.09227	0.07500	20398	9.923178	-0.00860	13.88972	13.89731	0.00760	11.09135	13.88972	0.01	0.733009

Table D-5
Housing Stock and Price Forecasts
Atlantic Provinces

[redacted]

1998-2016

[redacted]

1- GDP growth per adult = 1.73100
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 1 from Statistics Canada (weak growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation												
1996		878765								13.68627					
1997	68227	888326	11.13060			16884		0.00701	13.68627	13.69709	0.01082	11.13060	13.68627	0.01731	
1998	70181	899905	11.15884	11.13060	0.07500	17176	9.75128	0.00659	13.69709	13.71004	0.01295	11.15884	13.69709	0.01731	0.733009
1999	70610	912264	11.16493	11.15884	0.07500	17474	9.76845	0.00403	13.71004	13.72369	0.01364	11.16493	13.71004	0.01731	0.733009
2000	70773	925079	11.16723	11.16493	0.07500	17776	9.78561	0.00320	13.72369	13.73763	0.01395	11.16723	13.72369	0.01731	0.733009
2001	70032	937608	11.15671	11.16723	0.07500	18084	9.80277	-0.00026	13.73763	13.75109	0.01345	11.15671	13.73763	0.01731	0.733009
2002	68388	949097	11.13296	11.15671	0.07500	18397	9.81993	-0.00545	13.75109	13.76327	0.01218	11.13296	13.75109	0.01731	0.733009
2003	67479	959988	11.11957	11.13296	0.07500	18715	9.83709	-0.00663	13.76327	13.77468	0.01141	11.11957	13.76327	0.01731	0.733009
2004	67202	970701	11.11547	11.11957	0.07500	19039	9.85425	-0.00685	13.77468	13.78577	0.01110	11.11547	13.77468	0.01731	0.733009
2005	67267	981460	11.11642	11.11547	0.07500	19369	9.87142	-0.00695	13.78577	13.79680	0.01102	11.11642	13.78577	0.01731	0.733009
2006	67246	992172	11.11611	11.11642	0.07500	19704	9.88858	-0.00796	13.79680	13.80765	0.01086	11.11611	13.79680	0.01731	0.733009
2007	67340	1002908	11.11750	11.11611	0.07500	20045	9.90574	-0.00842	13.80765	13.81841	0.01076	11.11750	13.80765	0.01731	0.733009
2008	67421	1013644	11.11872	11.11750	0.07500	20392	9.92290	-0.00912	13.81841	13.82906	0.01065	11.11872	13.81841	0.01731	0.733009
2009	67295	1024203	11.11684	11.11872	0.07500	20745	9.94006	-0.01056	13.82906	13.83943	0.01036	11.11684	13.82906	0.01731	0.733009
2010	67199	1034600	11.11542	11.11684	0.07500	21104	9.95723	-0.01154	13.83943	13.84953	0.01010	11.11542	13.83943	0.01731	0.733009
2011	67326	1045009	11.11730	11.11542	0.07500	21469	9.97439	-0.01180	13.84953	13.85954	0.01001	11.11730	13.84953	0.01731	0.733009
2012	67056	1055098	11.11328	11.11730	0.07500	21841	9.99155	-0.01387	13.85954	13.86914	0.00961	11.11328	13.85954	0.01731	0.733009
2013	66903	1064958	11.11099	11.11328	0.07500	22219	10.00871	-0.01486	13.86914	13.87845	0.00930	11.11099	13.86914	0.01731	0.733009
2014	67164	1074937	11.11490	11.11099	0.07500	22604	10.02587	-0.01456	13.87845	13.88777	0.00933	11.11490	13.87845	0.01731	0.733009
2015	67685	1085251	11.12262	11.11490	0.07500	22995	10.04304	-0.01408	13.88777	13.89732	0.00955	11.12262	13.88777	0.01731	0.733009
2016	67833	1095583	11.12481	11.12262	0.07500	23393	10.06020	-0.01537	13.89732	13.90680	0.00948	11.12481	13.89732	0.01731	0.733009

Table D-6
Housing Stock and Price Forecasts
Atlantic Provinces

Atlantic Provinces

1998-2016

Medium-Medium Scenario: Medium Economic Growth and Medium Demographic Growth

1- GDP growth per adult = 1.73100
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 2 from Statistics Canada (medium growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

Forecasts			Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25,54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	N(t)
1996		878765								13.68627					
1997	68227	888326	11.13060			16884		0.00701	13.68627	13.69709	0.01082	11.13060	13.68627	0.01731	
1998	70303	899987	11.16057	11.13060	0.07500	17176	9.75128	0.00701	13.69709	13.71014	0.01304	11.16057	13.69709	0.01731	0.733009
1999	70801	912478	11.16763	11.16057	0.07500	17474	9.76845	0.00448	13.71014	13.72392	0.01378	11.16763	13.71014	0.01731	0.733009
2000	71009	925451	11.17056	11.16763	0.07500	17778	9.78561	0.00370	13.72392	13.73804	0.01412	11.17056	13.72392	0.01731	0.733009
2001	70359	938207	11.16136	11.17056	0.07500	18084	9.80277	0.00049	13.73804	13.75173	0.01369	11.16136	13.73804	0.01731	0.733009
2002	68765	949966	11.13846	11.16136	0.07500	18397	9.81993	-0.00463	13.75173	13.76418	0.01246	11.13846	13.75173	0.01731	0.733009
2003	67896	961162	11.12573	11.13846	0.07500	18715	9.83709	-0.00574	13.76418	13.77590	0.01172	11.12573	13.76418	0.01731	0.733009
2004	67651	972205	11.12212	11.12573	0.07500	19039	9.35425	-0.00589	13.77590	13.78732	0.01142	11.12212	13.77590	0.01731	0.733009
2005	67745	983316	11.12350	11.12212	0.07500	19369	9.87142	-0.00593	13.78732	13.79869	0.01136	11.12350	13.78732	0.01731	0.733009
2006	67814	994451	11.12452	11.12350	0.07500	19704	9.88858	-0.00665	13.79869	13.80995	0.01126	11.12452	13.79869	0.01731	0.733009
2007	67971	1005659	11.12684	11.12452	0.07500	20045	9.90574	-0.00702	13.80995	13.82115	0.01121	11.12684	13.80995	0.01731	0.733009
2008	68101	1016905	11.12875	11.12684	0.07500	20392	9.92290	-0.00764	13.82115	13.83227	0.01112	11.12875	13.82115	0.01731	0.733009
2009	68019	1028011	11.12755	11.12875	0.07500	20745	9.94006	-0.00897	13.83227	13.84314	0.01086	11.12755	13.83227	0.01731	0.733009
2010	67964	1038988	11.12674	11.12755	0.07500	21104	9.95723	-0.00985	13.84314	13.85376	0.01062	11.12674	13.84314	0.01731	0.733009
2011	68130	1050007	11.12917	11.12674	0.07500	21469	9.97439	-0.01001	13.85376	13.86431	0.01055	11.12917	13.85376	0.01731	0.733009
2012	67897	1060739	11.12575	11.12917	0.07500	21841	9.99155	-0.01196	13.86431	13.87448	0.01017	11.12575	13.86431	0.01731	0.733009
2013	67781	1071273	11.12403	11.12575	0.07500	22219	10.00871	-0.01286	13.87448	13.88436	0.00988	11.12403	13.87448	0.01731	0.733009
2014	68081	1081954	11.12846	11.12403	0.07500	22604	10.02587	-0.01248	13.88436	13.89428	0.00992	11.12846	13.88436	0.01731	0.733009
2015	68638	1092997	11.13861	11.12846	0.07500	22995	10.04304	-0.01191	13.89428	13.90443	0.01015	11.13861	13.89428	0.01731	0.733009
2016	68823	1104086	11.13929	11.13861	0.07500	23393	10.06020	-0.01310	13.90443	13.91453	0.01009	11.13929	13.90443	0.01731	0.733009

Table D-7
Housing Stock and Price Forecasts
Atlantic Provinces

Atlantic Provinces

1998-2016

Medium/Strong Scenario: Medium Economic Growth and Strong Demographic Growth

1- GDP growth per adult = 1.73100
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 3 from Statistics Canada (strong growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		878765								13.68627					
1997	68227	888326	11.13060			16884		0.00701	13.68627	13.69709	0.01082	11.13060	13.68627	0.01731	
1998	71175	900571	11.17290	11.13060	0.07500	17176	9.75128	0.00999	13.69709	13.71078	0.01369	11.17290	13.69709	0.01731	0.733009
1999	72205	914001	11.18727	11.17290	0.07500	17474	9.76845	0.00782	13.71078	13.72559	0.01480	11.18727	13.71078	0.01731	0.733009
2000	72680	928104	11.19383	11.18727	0.07500	17776	9.78561	0.00711	13.72559	13.74090	0.01531	11.19383	13.72559	0.01731	0.733009
2001	72200	942123	11.18720	11.19383	0.07500	18084	9.80277	0.00416	13.74090	13.75589	0.01499	11.18720	13.74090	0.01731	0.733009
2002	70650	955210	11.16550	11.18720	0.07500	18397	9.81993	-0.00089	13.75589	13.76969	0.01380	11.16550	13.75589	0.01731	0.733009
2003	69799	967769	11.15337	11.16550	0.07500	18715	9.83709	-0.00192	13.76969	13.78275	0.01306	11.15337	13.76969	0.01731	0.733009
2004	69559	980186	11.14993	11.15337	0.07500	19039	9.85425	-0.00203	13.78275	13.79550	0.01275	11.14993	13.78275	0.01731	0.733009
2005	69655	992678	11.15131	11.14993	0.07500	19369	9.87142	-0.00201	13.79550	13.80816	0.01266	11.15131	13.79550	0.01731	0.733009
2006	69758	1005223	11.15279	11.15131	0.07500	19704	9.88858	-0.00253	13.80816	13.82072	0.01256	11.15279	13.80816	0.01731	0.733009
2007	69934	1017856	11.15530	11.15279	0.07500	20045	9.90574	-0.00283	13.82072	13.83321	0.01249	11.15530	13.82072	0.01731	0.733009
2008	70057	1030525	11.15706	11.15530	0.07500	20392	9.92290	-0.00344	13.83321	13.84558	0.01237	11.15706	13.83321	0.01731	0.733009
2009	69960	1043044	11.15568	11.15706	0.07500	20745	9.94006	-0.00472	13.84558	13.85765	0.01208	11.15568	13.84558	0.01731	0.733009
2010	69893	1055427	11.15472	11.15568	0.07500	21104	9.95723	-0.00555	13.85765	13.86946	0.01180	11.15472	13.85765	0.01731	0.733009
2011	70039	1067836	11.15680	11.15472	0.07500	21469	9.97439	-0.00571	13.86946	13.88115	0.01169	11.15680	13.86946	0.01731	0.733009
2012	69786	1079944	11.15319	11.15680	0.07500	21841	9.99155	-0.00761	13.88115	13.89242	0.01127	11.15319	13.88115	0.01731	0.733009
2013	69656	1091842	11.15133	11.15319	0.07500	22219	10.00871	-0.00844	13.89242	13.90338	0.01096	11.15133	13.89242	0.01731	0.733009
2014	69945	1103874	11.15547	11.15133	0.07500	22604	10.02587	-0.00805	13.90338	13.91434	0.01096	11.15547	13.90338	0.01731	0.733009
2015	70493	1116256	11.16327	11.15547	0.07500	22995	10.04304	-0.00747	13.91434	13.92549	0.01115	11.16327	13.91434	0.01731	0.733009
2016	70671	1128677	11.16579	11.16327	0.07500	23393	10.06020	-0.00860	13.92549	13.93656	0.01107	11.16579	13.92549	0.01731	0.733009

Table D-8
Housing Stock and Price Forecasts
Quebec

[redacted]

Programming: Mario Fortin and André Leclerc

Quebec

1998-2016

Weak/Weak Scenario: Weak Economic Growth and Weak Demographic Growth

1- GDP growth per adult = 1.00000
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 1 from Statistics Canada (weak growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

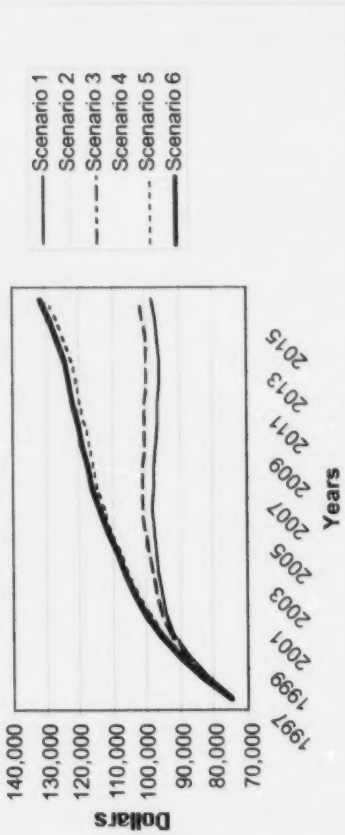
	Forecasts		Price Equation						Housing Stock Variation Equation						
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		2992625								14.91166					
1997	74754	3020928	11.22196			20146		0.00160	14.91166	14.92107	0.00941	11.22196	14.91166	0.01	
1998	82219	3059620	11.31714	11.22196	0.07500	20347	9.92071	0.00342	14.92107	14.93380	0.01273	11.31714	14.92107	0.01	0.784649
1999	87780	3105391	11.38259	11.31714	0.07500	20551	9.93066	0.00312	14.93380	14.94865	0.01485	11.38259	14.93380	0.01	0.784649
2000	91919	3156049	11.42867	11.38259	0.07500	20756	9.94061	0.00332	14.94865	14.96483	0.01618	11.42867	14.94865	0.01	0.784649
2001	94322	3209324	11.45447	11.42867	0.07500	20964	9.95056	0.00109	14.96483	14.98157	0.01674	11.45447	14.96483	0.01	0.784649
2002	95716	3263900	11.46914	11.45447	0.07500	21174	9.96051	-0.00019	14.98157	14.99843	0.01686	11.46914	14.98157	0.01	0.784649
2003	96672	3319140	11.47908	11.46914	0.07500	21385	9.97046	-0.00045	14.99843	15.01522	0.01678	11.47908	14.99843	0.01	0.784649
2004	97358	3374627	11.48615	11.47908	0.07500	21599	9.98041	-0.00061	15.01522	15.03180	0.01658	11.48615	15.01522	0.01	0.784649
2005	98101	3430331	11.49376	11.48615	0.07500	21815	9.99036	0.00008	15.03180	15.04817	0.01637	11.49376	15.03180	0.01	0.784649
2006	98202	3485438	11.49478	11.49376	0.07500	22033	10.00031	-0.00176	15.04817	15.06410	0.01594	11.49478	15.04817	0.01	0.784649
2007	98137	3539689	11.49412	11.49478	0.07500	22254	10.01026	-0.00266	15.06410	15.07955	0.01545	11.49412	15.06410	0.01	0.784649
2008	97837	3592748	11.49106	11.49412	0.07500	22476	10.02021	-0.00409	15.07955	15.09443	0.01488	11.49106	15.07955	0.01	0.784649
2009	97404	3644407	11.48662	11.49106	0.07500	22701	10.03017	-0.00551	15.09443	15.10870	0.01428	11.48662	15.09443	0.01	0.784649
2010	96995	3694653	11.48241	11.48662	0.07500	22928	10.04012	-0.00659	15.10870	15.12240	0.01369	11.48241	15.10870	0.01	0.784649
2011	96907	3743859	11.48151	11.48241	0.07500	23157	10.05007	-0.00662	15.12240	15.13563	0.01323	11.48151	15.12240	0.01	0.784649
2012	96424	3791503	11.47651	11.48151	0.07500	23389	10.06002	-0.00898	15.13563	15.14827	0.01265	11.47651	15.13563	0.01	0.784649
2013	96214	3837915	11.47433	11.47651	0.07500	23623	10.06997	-0.00942	15.14827	15.16044	0.01217	11.47433	15.14827	0.01	0.784649
2014	96521	3883766	11.47752	11.47433	0.07500	23859	10.07992	-0.00866	15.16044	15.17232	0.01188	11.47752	15.16044	0.01	0.784649
2015	97416	3929819	11.48675	11.47752	0.07500	24098	10.08987	-0.00707	15.17232	15.18410	0.01179	11.48675	15.17232	0.01	0.784649
2016	98370	3976138	11.49649	11.48675	0.07500	24339	10.09982	-0.00677	15.18410	15.19582	0.01172	11.49649	15.18410	0.01	0.784649

Table D-9

Housing Stock and Price Foregasts

Quebec

Comparison of Results



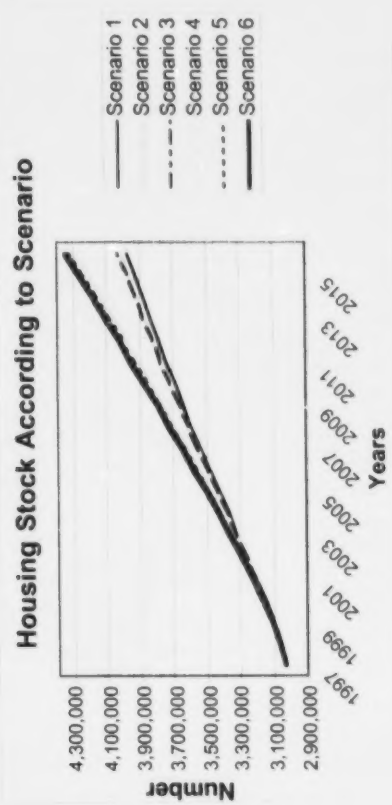


Table D-10
Housing Stock and Price Forecasts
Quebec

Quebec

1998-2016

Weak/Medium Scenario: Weak Economic Growth and Medium Demographic Growth

1- GDP growth per adult = 1.00000
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 2 from Statistics Canada (medium growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		2992625								14.91166					
1997	74754	3020928	11.22196			20146		0.00160	14.91166	14.92107	0.00941	11.22196	14.91166	0.01	
1998	82517	3059978	11.32075	11.22196	0.07500	20347	9.92071	0.00472	14.92107	14.93392	0.01284	11.32075	14.92107	0.01	0.78465
1999	88315	3106355	11.38867	11.32075	0.07500	20551	9.93066	0.00445	14.93392	14.94896	0.01504	11.38867	14.93392	0.01	0.78465
2000	92633	3157787	11.43640	11.38867	0.07500	20756	9.94061	0.00468	14.94896	14.96538	0.01642	11.43640	14.94896	0.01	0.78465
2001	95389	3212204	11.46571	11.43640	0.07500	20964	9.95056	0.00334	14.96538	14.98247	0.01709	11.46571	14.96538	0.01	0.78465
2002	97029	3268174	11.48276	11.46571	0.07500	21174	9.96051	0.00212	14.98247	14.99974	0.01727	11.48276	14.98247	0.01	0.78465
2003	98152	3324979	11.49427	11.48276	0.07500	21385	9.97046	0.00190	14.99974	15.01697	0.01723	11.49427	14.99974	0.01	0.78465
2004	98948	3382141	11.50235	11.49427	0.07500	21599	9.98041	0.00178	15.01697	15.03402	0.01705	11.50235	15.01697	0.01	0.78465
2005	99758	3439582	11.51051	11.50235	0.07500	21815	9.99036	0.00249	15.03402	15.05086	0.01684	11.51051	15.03402	0.01	0.78465
2006	100133	3496731	11.51425	11.51051	0.07500	22033	10.0003	0.00156	15.05086	15.06734	0.01648	11.51425	15.05086	0.01	0.78465
2007	100251	3553229	11.51543	11.51425	0.07500	22254	10.0103	0.00073	15.06734	15.08337	0.01603	11.51543	15.06734	0.01	0.78465
2008	100069	3608671	11.51362	11.51543	0.07500	22476	10.0202	-0.00061	15.08337	15.09885	0.01548	11.51362	15.08337	0.01	0.78465
2009	99713	3662801	11.51005	11.51362	0.07500	22701	10.0302	-0.00194	15.09885	15.11374	0.01489	11.51005	15.09885	0.01	0.78465
2010	99355	3715573	11.50645	11.51005	0.07500	22928	10.0401	-0.00293	15.11374	15.12804	0.01430	11.50645	15.11374	0.01	0.78465
2011	99299	3767326	11.50589	11.50645	0.07500	23157	10.0501	-0.00290	15.12804	15.14188	0.01383	11.50589	15.12804	0.01	0.78465
2012	98843	3817538	11.50128	11.50589	0.07500	23389	10.06	-0.00513	15.14188	15.15512	0.01324	11.50128	15.14188	0.01	0.78465
2013	98652	3866524	11.49935	11.50128	0.07500	23623	10.07	-0.00549	15.15512	15.16787	0.01275	11.49935	15.15512	0.01	0.78465
2014	98969	3914924	11.50256	11.49935	0.07500	23859	10.0799	-0.00471	15.16787	15.18031	0.01244	11.50256	15.16787	0.01	0.78465
2015	99857	3963470	11.51149	11.50256	0.07500	24098	10.0899	-0.00315	15.18031	15.19263	0.01232	11.51149	15.18031	0.01	0.78465
2016	100797	4012214	11.52086	11.51149	0.07500	24339	10.0998	-0.00284	15.19263	15.20485	0.01222	11.52086	15.19263	0.01	0.78465

Table D-11
Housing Stock and Price Forecasts
Quebec

Quebec

1998-2016

Weak/Strong Scenario: Weak Economic Growth and Strong Demographic Growth

1- GDP growth per adult = 1.00000
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 3 from Statistics Canada (strong growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	N(25,54)	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		2992625								14.91166					
1997	74754	3020928	11.22196			20146		0.00160	14.91166	14.92107	0.00941	11.22196	14.91166	0.01	
1998	82563	3060035	11.32132	11.22196	0.07500	20347	9.920711	0.00492	14.92107	14.93394	0.01286	11.32132	14.92107	0.01	0.784649
1999	88388	3106494	11.38950	11.32132	0.07500	20551	9.930662	0.00462	14.93394	14.94901	0.01507	11.38950	14.93394	0.01	0.784649
2000	92710	3158009	11.43723	11.38950	0.07500	20756	9.940612	0.00478	14.94901	14.96545	0.01645	11.43723	14.94901	0.01	0.784649
2001	95692	3212753	11.46889	11.43723	0.07500	20964	9.950562	0.00429	14.96545	14.98264	0.01719	11.46889	14.96545	0.01	0.784649
2002	97489	3269216	11.48750	11.46889	0.07500	21174	9.960513	0.00308	14.98264	15.00006	0.01742	11.48750	14.98264	0.01	0.784649
2003	98724	3326631	11.50009	11.48750	0.07500	21385	9.970463	0.00289	15.00006	15.01747	0.01741	11.50009	15.00006	0.01	0.784649
2004	99596	3384483	11.50888	11.50009	0.07500	21599	9.980413	0.00279	15.01747	15.03471	0.01724	11.50888	15.01747	0.01	0.784649
2005	100460	3442665	11.51751	11.50888	0.07500	21815	9.990364	0.00352	15.03471	15.05176	0.01704	11.51751	15.03471	0.01	0.784649
2006	101031	3500774	11.52318	11.51751	0.07500	22033	10.00031	0.00320	15.05176	15.06849	0.01674	11.52318	15.05176	0.01	0.784649
2007	101297	3558397	11.52581	11.52318	0.07500	22254	10.01026	0.00247	15.06849	15.08482	0.01633	11.52581	15.06849	0.01	0.784649
2008	101219	3615084	11.52505	11.52581	0.07500	22476	10.02021	0.00119	15.08482	15.10063	0.01580	11.52505	15.08482	0.01	0.784649
2009	100932	3670539	11.52220	11.52505	0.07500	22701	10.03017	-0.00009	15.10063	15.11585	0.01522	11.52220	15.10063	0.01	0.784649
2010	100624	3724693	11.51915	11.52220	0.07500	22928	10.04012	-0.00102	15.11585	15.13050	0.01465	11.51915	15.11585	0.01	0.784649
2011	100601	3777860	11.51892	11.51915	0.07500	23157	10.05007	-0.00096	15.13050	15.14467	0.01417	11.51892	15.13050	0.01	0.784649
2012	100171	3829513	11.51464	11.51892	0.07500	23389	10.06002	-0.00309	15.14467	15.15825	0.01358	11.51464	15.14467	0.01	0.784649
2013	100000	3879955	11.51292	11.51464	0.07500	23623	10.06997	-0.00341	15.15825	15.17133	0.01309	11.51292	15.15825	0.01	0.784649
2014	100323	3929801	11.51615	11.51292	0.07500	23859	10.07992	-0.00264	15.17133	15.18410	0.01277	11.51615	15.17133	0.01	0.784649
2015	101204	3979757	11.52490	11.51615	0.07500	24098	10.08987	-0.00111	15.18410	15.19673	0.01263	11.52490	15.18410	0.01	0.784649
2016	102129	4029867	11.53400	11.52490	0.07500	24339	10.09982	-0.00081	15.19673	15.20924	0.01251	11.53400	15.19673	0.01	0.784649

Table D-12
Housing Stock and Price Forecasts
Quebec

[redacted]

Quebec

1996-2016

Medium/Weak Scenario: Medium Economic Growth and Weak Demographic Growth

1- GDP growth per adult = 1.87870
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 1 from Statistics Canada (weak growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		2992625								14.91166					
1997	74754	3020928	11.22196			20146		0.00160	14.91166	14.92107	0.00941	11.22196	14.91166	0.018787	
1998	82726	3060686	11.32329	11.22196	0.07500	20524	9.92937374	0.00342	14.92107	14.93415	0.01308	11.32329	14.92107	0.018787	0.784649
1999	89222	3108906	11.39888	11.32329	0.07500	20910	9.94798644	0.00312	14.93415	14.94978	0.01563	11.39888	14.93415	0.018787	0.784649
2000	94620	3163601	11.45763	11.39888	0.07500	21303	9.96659915	0.00332	14.94978	14.96722	0.01744	11.45763	14.94978	0.018787	0.784649
2001	98481	3222637	11.49762	11.45763	0.07500	21703	9.98521185	0.00109	14.96722	14.98571	0.01849	11.49762	14.96722	0.018787	0.784649
2002	101450	3284770	11.52732	11.49762	0.07500	22111	10.0038246	-0.00019	14.98571	15.00481	0.01910	11.52732	14.98571	0.018787	0.784649
2003	104054	3349409	11.55267	11.52732	0.07500	22526	10.0224373	-0.00045	15.00481	15.02429	0.01949	11.55267	15.00481	0.018787	0.784649
2004	106430	3416151	11.57524	11.55267	0.07500	22949	10.04105	-0.00061	15.02429	15.04403	0.01973	11.57524	15.02429	0.018787	0.784649
2005	108905	3484968	11.59823	11.57524	0.07500	23381	10.0596627	0.00008	15.04403	15.06397	0.01994	11.59823	15.04403	0.018787	0.784649
2006	110681	3555024	11.61441	11.59823	0.07500	23820	10.0782754	-0.00176	15.06397	15.08387	0.01990	11.61441	15.06397	0.018787	0.784649
2007	112265	3626035	11.62862	11.61441	0.07500	24267	10.0968881	-0.00266	15.08387	15.10365	0.01978	11.62862	15.08387	0.018787	0.784649
2008	113558	3697624	11.64007	11.62862	0.07500	24723	10.1155008	-0.00409	15.10365	15.12320	0.01955	11.64007	15.10365	0.018787	0.784649
2009	114669	3769540	11.64981	11.64007	0.07500	25188	10.1341135	-0.00551	15.12320	15.14246	0.01926	11.64981	15.12320	0.018787	0.784649
2010	115777	3841728	11.65942	11.64981	0.07500	25661	10.1527262	-0.00659	15.14246	15.16143	0.01897	11.65942	15.14246	0.018787	0.784649
2011	117242	3914534	11.67199	11.65942	0.07500	26143	10.1713389	-0.00662	15.16143	15.18021	0.01877	11.67199	15.16143	0.018787	0.784649
2012	118201	3987369	11.68015	11.67199	0.07500	26634	10.1899516	-0.00898	15.18021	15.19864	0.01844	11.68015	15.18021	0.018787	0.784649
2013	119467	4060538	11.69079	11.68015	0.07500	27135	10.2085643	-0.00942	15.19864	15.21683	0.01818	11.69079	15.19864	0.018787	0.784649
2014	121361	4134711	11.70652	11.69079	0.07500	27644	10.227177	-0.00866	15.21683	15.23493	0.01810	11.70652	15.21683	0.018787	0.784649
2015	123998	4210679	11.72802	11.70652	0.07500	28164	10.2457897	-0.00707	15.23493	15.25313	0.01821	11.72802	15.23493	0.018787	0.784649
2016	126725	4288502	11.74977	11.72802	0.07500	28693	10.2644024	-0.00677	15.25313	15.27145	0.01831	11.74977	15.25313	0.018787	0.784649

Table D-13
Housing Stock and Price Forecasts
Quebec

[redacted]

1998-2016

[redacted]

1- GDP growth per adult = 1.87870
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 2 from Statistics Canada (medium growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation													
1996		2992625								14.91166						
1997	74754	3020928	11.22196			20146		0.00160	14.91166	14.92107	0.00941	11.22196	14.91166	0.018787		
1998	83025	3061045	11.32690	11.22196	0.07500	20524	9.92937374	0.00472	14.92107	14.93427	0.01319	11.32690	14.92107	0.018787	0.784649	
1999	89766	3109870	11.40496	11.32690	0.07500	20910	9.94798644	0.00445	14.93427	14.95009	0.01582	11.40496	14.93427	0.018787	0.784649	
2000	95355	3165344	11.46536	11.40496	0.07500	21303	9.96659915	0.00468	14.95009	14.96777	0.01768	11.46536	14.95009	0.018787	0.784649	
2001	99595	3225528	11.50886	11.46536	0.07500	21703	9.98521185	0.00334	14.96777	14.98661	0.01884	11.50886	14.96777	0.018787	0.784649	
2002	102841	3289072	11.54094	11.50886	0.07500	22111	10.0038246	0.00212	14.98661	15.00612	0.01951	11.54094	14.98661	0.018787	0.784649	
2003	105647	3355302	11.56786	11.54094	0.07500	22526	10.0224373	0.00190	15.00612	15.02605	0.01994	11.56786	15.00612	0.018787	0.784649	
2004	108167	3423757	11.59143	11.56786	0.07500	22949	10.04105	0.00178	15.02605	15.04625	0.02020	11.59143	15.02605	0.018787	0.784649	
2005	110745	3494366	11.61498	11.59143	0.07500	23381	10.0596627	0.00249	15.04625	15.06666	0.02041	11.61498	15.04625	0.018787	0.784649	
2006	112858	3566543	11.63389	11.61498	0.07500	23820	10.0782754	0.00156	15.06666	15.08711	0.02044	11.63389	15.06666	0.018787	0.784649	
2007	114683	3639905	11.64993	11.63389	0.07500	24267	10.0968881	0.00073	15.08711	15.10747	0.02036	11.64993	15.08711	0.018787	0.784649	
2008	116150	3714012	11.66264	11.64993	0.07500	24723	10.1155008	-0.00061	15.10747	15.12762	0.02016	11.66264	15.10747	0.018787	0.784649	
2009	117388	3788566	11.67324	11.66264	0.07500	25188	10.1341135	-0.00194	15.12762	15.14750	0.01987	11.67324	15.12762	0.018787	0.784649	
2010	118594	3863480	11.68346	11.67324	0.07500	25661	10.1527262	-0.00293	15.14750	15.16708	0.01958	11.68346	15.14750	0.018787	0.784649	
2011	120136	3939070	11.69638	11.68346	0.07500	26143	10.1713389	-0.00290	15.16708	15.18646	0.01938	11.69638	15.16708	0.018787	0.784649	
2012	121166	4014749	11.70491	11.69638	0.07500	26634	10.1899516	-0.00513	15.18646	15.20549	0.01903	11.70491	15.18646	0.018787	0.784649	
2013	122494	4090806	11.71582	11.70491	0.07500	27135	10.2085643	-0.00549	15.20549	15.22425	0.01877	11.71582	15.20549	0.018787	0.784649	
2014	124438	4167883	11.73156	11.71582	0.07500	27644	10.227177	-0.00471	15.22425	15.24292	0.01867	11.73156	15.22425	0.018787	0.784649	
2015	127105	4246735	11.75277	11.73156	0.07500	28164	10.2457897	-0.00315	15.24292	15.26166	0.01874	11.75277	15.24292	0.018787	0.784649	
2016	129851	4327412	11.77414	11.75277	0.07500	28693	10.2644024	-0.00284	15.26166	15.28048	0.01882	11.77414	15.26166	0.018787	0.784649	

Table D-14
Housing Stock and Price Forecasts
Quebec

Quebec

1998-2016

Medium/Strong Scenario: Medium Economic Growth and Strong Demographic Growth

1- GDP growth per adult = 1.87870
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 3 from Statistics Canada (strong growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		2992625								14.91166					
1997	74754	3020928	11.22196			20146		0.00160	14.91166	14.92107	0.00941	11.22196	14.91166	0.018787	
1998	83072	3061101	11.32747	11.22196	0.07500	20524	9.929374	0.00492	14.92107	14.93429	0.01321	11.32747	14.92107	0.018787	0.784649
1999	89840	3110009	11.40579	11.32747	0.07500	20910	9.947986	0.00462	14.93429	14.95014	0.01585	11.40579	14.93429	0.018787	0.784649
2000	95434	3165566	11.46619	11.40579	0.07500	21303	9.966599	0.00478	14.95014	14.96784	0.01771	11.46619	14.95014	0.018787	0.784649
2001	99911	3226079	11.51204	11.46619	0.07500	21703	9.985212	0.00429	14.96784	14.98678	0.01894	11.51204	14.96784	0.018787	0.784649
2002	103329	3290120	11.54568	11.51204	0.07500	22111	10.00382	0.00308	14.98678	15.00643	0.01966	11.54568	14.98678	0.018787	0.784649
2003	106263	3356969	11.57368	11.54568	0.07500	22526	10.02244	0.00289	15.00643	15.02655	0.02011	11.57368	15.00643	0.018787	0.784649
2004	108876	3426128	11.59797	11.57368	0.07500	22949	10.04105	0.00279	15.02655	15.04694	0.02039	11.59797	15.02655	0.018787	0.784649
2005	111523	3497498	11.62199	11.59797	0.07500	23381	10.05966	0.00352	15.04694	15.06756	0.02062	11.62199	15.04694	0.018787	0.784649
2006	113870	3570666	11.64281	11.62199	0.07500	23820	10.07828	0.00320	15.06756	15.08826	0.02070	11.64281	15.06756	0.018787	0.784649
2007	115879	3645200	11.66030	11.64281	0.07500	24267	10.09689	0.00247	15.08826	15.10892	0.02066	11.66030	15.08826	0.018787	0.784649
2008	117485	3720612	11.67406	11.66030	0.07500	24723	10.1155	0.00119	15.10892	15.12940	0.02048	11.67406	15.10892	0.018787	0.784649
2009	118823	3796569	11.68539	11.67406	0.07500	25188	10.13411	-0.00009	15.12940	15.14961	0.02021	11.68539	15.12940	0.018787	0.784649
2010	120109	3872964	11.69616	11.68539	0.07500	25661	10.15273	-0.00102	15.14961	15.16953	0.01992	11.69616	15.14961	0.018787	0.784649
2011	121711	3950084	11.70940	11.69616	0.07500	26143	10.17134	-0.00096	15.16953	15.18925	0.01972	11.70940	15.16953	0.018787	0.784649
2012	122795	4027343	11.71827	11.70940	0.07500	26634	10.18995	-0.00309	15.18925	15.20862	0.01937	11.71827	15.18925	0.018787	0.784649
2013	124168	4105016	11.72939	11.71827	0.07500	27135	10.20856	-0.00341	15.20862	15.22772	0.01910	11.72939	15.20862	0.018787	0.784649
2014	126141	4183720	11.74516	11.72939	0.07500	27644	10.22718	-0.00264	15.22772	15.24671	0.01899	11.74516	15.22772	0.018787	0.784649
2015	128820	4264186	11.76617	11.74516	0.07500	28164	10.24579	-0.00111	15.24671	15.26576	0.01905	11.76617	15.24671	0.018787	0.784649
2016	131568	4346451	11.78728	11.76617	0.07500	28693	10.2644	-0.00081	15.26576	15.28487	0.01911	11.78728	15.26576	0.018787	0.784649

Table D-15
Housing Stock and Price Forecasts
Ontario

[redacted]

Programming: Mario Fortin and André Leclerc

Ontario

1998-2016

Weak/Weak Scenario: Weak Economic Growth and Weak Demographic Growth

1- GDP growth per adult = 1.00000
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 1 from Statistics Canada (weak growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

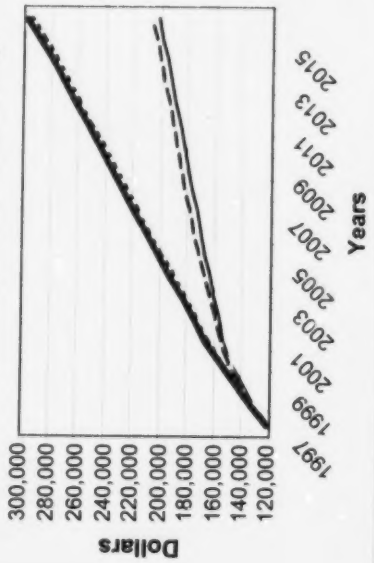
	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		4144328								15.23725					
1997	120766	4198891	11.70161			24708		0.01554	15.23725	15.25033	0.01308	11.70161	15.23725	0.01	
1998	131682	4265324	11.78814	11.70161	0.07500	24955	10.12483	0.01470	15.25033	15.26603	0.01570	11.78814	15.25033	0.01	0.398192
1999	140677	4340554	11.85422	11.78814	0.07500	25205	10.13478	0.01376	15.26603	15.28351	0.01748	11.85422	15.26603	0.01	0.398192
2000	148313	4422446	11.90708	11.85422	0.07500	25457	10.14473	0.01409	15.28351	15.30220	0.01869	11.90708	15.28351	0.01	0.398192
2001	153883	4508191	11.94395	11.90708	0.07500	25711	10.15468	0.01063	15.30220	15.32141	0.01920	11.94395	15.30220	0.01	0.398192
2002	157481	4595281	11.96706	11.94395	0.07500	25968	10.16463	0.00573	15.32141	15.34054	0.01913	11.96706	15.32141	0.01	0.398192
2003	161022	4683594	11.98930	11.96706	0.07500	26228	10.17458	0.00630	15.34054	15.35958	0.01904	11.98930	15.34054	0.01	0.398192
2004	164568	4773080	12.01108	11.98930	0.07500	26490	10.18453	0.00693	15.35958	15.37850	0.01893	12.01108	15.35958	0.01	0.398192
2005	168107	4863672	12.03236	12.01108	0.07500	26755	10.19449	0.00742	15.37850	15.39730	0.01880	12.03236	15.37850	0.01	0.398192
2006	171119	4954686	12.05011	12.03236	0.07500	27023	10.20444	0.00589	15.39730	15.41584	0.01854	12.05011	15.39730	0.01	0.398192
2007	174178	5046145	12.06783	12.05011	0.07500	27293	10.21439	0.00579	15.41584	15.43414	0.01829	12.06783	15.41584	0.01	0.398192
2008	177239	5138017	12.08526	12.06783	0.07500	27566	10.22434	0.00544	15.43414	15.45218	0.01804	12.08526	15.43414	0.01	0.398192
2009	180217	5230168	12.10192	12.08526	0.07500	27842	10.23429	0.00467	15.45218	15.46995	0.01778	12.10192	15.45218	0.01	0.398192
2010	183282	5322672	12.11878	12.10192	0.07500	28120	10.24424	0.00428	15.46995	15.48749	0.01753	12.11878	15.46995	0.01	0.398192
2011	186545	5415734	12.13643	12.11878	0.07500	28401	10.25419	0.00421	15.48749	15.50482	0.01733	12.13643	15.48749	0.01	0.398192
2012	189541	5508995	12.15236	12.13643	0.07500	28685	10.26414	0.00266	15.50482	15.52189	0.01707	12.15236	15.50482	0.01	0.398192
2013	192551	5602448	12.16812	12.15236	0.07500	28972	10.27409	0.00167	15.52189	15.53871	0.01682	12.16812	15.52189	0.01	0.398192
2014	195802	5696354	12.18486	12.16812	0.07500	29262	10.28404	0.00129	15.53871	15.55534	0.01662	12.18486	15.53871	0.01	0.398192
2015	199467	5791168	12.20340	12.18486	0.07500	29554	10.29399	0.00154	15.55534	15.57184	0.01651	12.20340	15.55534	0.01	0.398192
2016	203088	5886789	12.22140	12.20340	0.07500	29850	10.30394	0.00062	15.57184	15.58822	0.01638	12.22140	15.57184	0.01	0.398192

Table D-16

Housing Stock and Price Forecasts

Ontario

Comparison of Results



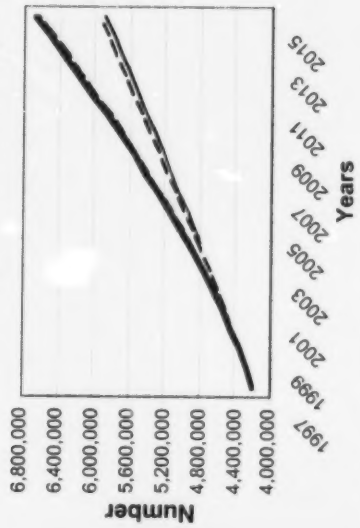


Tableau D-17
Housing Stock and Price Forecasts
Ontario

[redacted]

1996-2016

[redacted]

1- GDP growth per adult = 1.00000
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 2 from Statistics Canada (medium growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation												
1996		4144328													
1997	120766	4198891	11.70161			24708		0.01554	15.23725	15.23725					
1998	132153	4265948	11.79171	11.70161	0.07500	24955	10.1248	0.01693	15.25033	15.25033	0.01308	11.70161	15.23725	0.01	
1999	141521	4342217	11.86020	11.79171	0.07500	25205	10.1348	0.01598	15.26617	15.26617	0.01584	11.79171	15.25033	0.01	0.39819
2000	149428	4425410	11.91457	11.86020	0.07500	25457	10.1447	0.01628	15.28390	15.28390	0.01772	11.86020	15.26617	0.01	0.39819
2001	155564	4513062	11.95482	11.91457	0.07500	25711	10.1547	0.01434	15.30287	15.30287	0.01898	11.91457	15.28390	0.01	0.39819
2002	159556	4602450	11.98015	11.95482	0.07500	25968	10.1646	0.00949	15.32249	15.32249	0.01961	11.95482	15.30287	0.01	0.39819
2003	163355	4693280	12.00368	11.98015	0.07500	26228	10.1746	0.01004	15.34210	15.34210	0.01961	11.98015	15.32249	0.01	0.39819
2004	167053	4785368	12.02607	12.00368	0.07500	26490	10.1845	0.01065	15.36164	15.36164	0.01954	12.00368	15.34210	0.01	0.39819
2005	170663	4878547	12.04745	12.02607	0.07500	26755	10.1945	0.01109	15.38107	15.38107	0.01943	12.02607	15.36164	0.01	0.39819
2006	174094	4972551	12.06735	12.04745	0.07500	27023	10.2044	0.01101	15.40036	15.40036	0.01928	12.04745	15.38107	0.01	0.39819
2007	177417	5067204	12.08626	12.06735	0.07500	27293	10.2144	0.01088	15.41944	15.41944	0.01909	12.06735	15.40036	0.01	0.39819
2008	180626	5162329	12.10419	12.08626	0.07500	27566	10.2243	0.01052	15.43830	15.43830	0.01886	12.08626	15.41944	0.01	0.39819
2009	183669	5257695	12.12089	12.10419	0.07500	27842	10.2343	0.00973	15.45690	15.45690	0.01860	12.10419	15.43830	0.01	0.39819
2010	186738	5353304	12.13746	12.12089	0.07500	28120	10.2442	0.00930	15.47520	15.47520	0.01830	12.12089	15.45690	0.01	0.39819
2011	189963	5449307	12.15458	12.13746	0.07500	28401	10.2542	0.00918	15.49322	15.49322	0.01802	12.13746	15.47520	0.01	0.39819
2012	192905	5545339	12.16995	12.15458	0.07500	28685	10.2641	0.00765	15.51100	15.51100	0.01777	12.15458	15.49322	0.01	0.39819
2013	195853	5641385	12.18512	12.16995	0.07500	28972	10.2741	0.00667	15.52847	15.52847	0.01747	12.16995	15.51100	0.01	0.39819
2014	199030	5737695	12.20121	12.18512	0.07500	29262	10.284	0.00625	15.54564	15.54564	0.01717	12.18512	15.52847	0.01	0.39819
2015	202603	5834706	12.21900	12.20121	0.07500	29554	10.294	0.00642	15.56257	15.56257	0.01693	12.20121	15.54564	0.01	0.39819
2016	206142	5932334	12.23632	12.21900	0.07500	29850	10.3039	0.00549	15.57933	15.57933	0.01677	12.21900	15.56257	0.01	0.39819
										15.59593	0.01659	12.23632	15.57933	0.01	0.39819

Table D-18
Housing Stock and Price Forecasts
Ontario

Ontario

1998-2016

Weak/Strong Scenario: Weak Economic Growth and Strong Demographic Growth

1- GDP growth per adult = 1.00000
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 3 from Statistics Canada (strong growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population of 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		4144328								15.23725					
1997	120766	4198891	11.70161			24708		0.01554	15.23725	15.25033	0.01308	11.70161	15.23725	0.01	
1998	132281	4266118	11.79269	11.70161	0.07500	24955	10.12483	0.01754	15.25033	15.26621	0.01588	11.79269	15.25033	0.01	0.398192
1999	141723	4342635	11.86163	11.79269	0.07500	25205	10.13478	0.01645	15.26621	15.28399	0.01778	11.86163	15.26621	0.01	0.398192
2000	149664	4426099	11.91615	11.86163	0.07500	25457	10.14473	0.01667	15.28399	15.30303	0.01904	11.91615	15.28399	0.01	0.398192
2001	156209	4514492	11.95895	11.91615	0.07500	25711	10.15468	0.01628	15.30303	15.32280	0.01977	11.95895	15.30303	0.01	0.398192
2002	160508	4604954	11.98610	11.95895	0.07500	25968	10.16463	0.01149	15.32280	15.34264	0.01984	11.98610	15.32280	0.01	0.398192
2003	164523	4697069	12.01080	11.98610	0.07500	26228	10.17458	0.01206	15.34264	15.36245	0.01981	12.01080	15.34264	0.01	0.398192
2004	168361	4790557	12.03386	12.01080	0.07500	26490	10.18453	0.01265	15.36245	15.38216	0.01971	12.03386	15.36245	0.01	0.398192
2005	172050	4885179	12.05554	12.03386	0.07500	26755	10.19449	0.01308	15.38216	15.40172	0.01956	12.05554	15.38216	0.01	0.398192
2006	175775	4980914	12.07696	12.05554	0.07500	27023	10.20444	0.01389	15.40172	15.42112	0.01941	12.07696	15.40172	0.01	0.398192
2007	179264	5077431	12.09662	12.07696	0.07500	27293	10.21439	0.01368	15.42112	15.44032	0.01919	12.09662	15.42112	0.01	0.398192
2008	182564	5174461	12.11486	12.09662	0.07500	27566	10.22434	0.01328	15.44032	15.45925	0.01893	12.11486	15.44032	0.01	0.398192
2009	185646	5271711	12.13160	12.11486	0.07500	27842	10.23429	0.01248	15.45925	15.47787	0.01862	12.13160	15.45925	0.01	0.398192
2010	188709	5369131	12.14796	12.13160	0.07500	28120	10.24424	0.01201	15.47787	15.49618	0.01831	12.14796	15.47787	0.01	0.398192
2011	191904	5466845	12.16475	12.14796	0.07500	28401	10.25419	0.01187	15.49618	15.51421	0.01804	12.16475	15.49618	0.01	0.398192
2012	194808	5564483	12.17977	12.16475	0.07500	28685	10.26414	0.01035	15.51421	15.53191	0.01770	12.17977	15.51421	0.01	0.398192
2013	197710	5662023	12.19456	12.17977	0.07500	28972	10.27409	0.00936	15.53191	15.54929	0.01738	12.19456	15.53191	0.01	0.398192
2014	200837	5759710	12.21025	12.19456	0.07500	29262	10.28404	0.00892	15.54929	15.56640	0.01711	12.21025	15.54929	0.01	0.398192
2015	204337	5857959	12.22753	12.21025	0.07500	29554	10.29399	0.00900	15.56640	15.58331	0.01691	12.22753	15.56640	0.01	0.398192
2016	207813	5956700	12.24439	12.22753	0.07500	29850	10.30394	0.00806	15.58331	15.60003	0.01672	12.24439	15.58331	0.01	0.398192

Table D-19
Housing Stock and Price Forecasts
Ontario

Ontario

1998-2016

Medium/Weak Scenario: Medium Economic Growth and Weak Demographic Growth

1- GDP growth per adult = 1.60790
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 1 from Statistics Canada (weak growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

Forecasts			Price Equation							Housing Stock Variation Equation					
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		4144328								15.23725					
1997	120766	4198891	11.70161			24708		0.01554	15.23725	15.25033	0.01308	11.70161	15.23725	0.016079	
1998	132868	4267654	11.79711	11.70161	0.07500	25105	10.1308335	0.01470	15.25033	15.26657	0.01624	11.79711	15.25033	0.016079	0.398192
1999	144088	4348148	11.87818	11.79711	0.07500	25509	10.1467846	0.01376	15.26657	15.28526	0.01869	11.87818	15.26657	0.016079	0.398192
2000	154801	4438786	11.94990	11.87818	0.07500	25919	10.1627357	0.01409	15.28526	15.30589	0.02063	11.94990	15.28526	0.016079	0.398192
2001	164060	4537164	12.00799	11.94990	0.07500	26336	10.1786868	0.01063	15.30589	15.32781	0.02192	12.00799	15.30589	0.016079	0.398192
2002	171712	4641027	12.05357	12.00799	0.07500	26759	10.1946379	0.00573	15.32781	15.35045	0.02263	12.05357	15.32781	0.016079	0.398192
2003	179649	4750402	12.09876	12.05357	0.07500	27190	10.210589	0.00630	15.35045	15.37374	0.02329	12.09876	15.35045	0.016079	0.398192
2004	187858	4865295	12.14344	12.09876	0.07500	27627	10.2265401	0.00693	15.37374	15.39764	0.02390	12.14344	15.37374	0.016079	0.398192
2005	196266	4985640	12.18723	12.14344	0.07500	28071	10.2424912	0.00742	15.39764	15.42207	0.02443	12.18723	15.39764	0.016079	0.398192
2006	204203	5110692	12.22687	12.18723	0.07500	28522	10.2584423	0.00589	15.42207	15.44685	0.02477	12.22687	15.42207	0.016079	0.398192
2007	212295	5240395	12.26573	12.22687	0.07500	28981	10.2743934	0.00579	15.44685	15.47191	0.02506	12.26573	15.44685	0.016079	0.398192
2008	220469	5374621	12.30351	12.26573	0.07500	29447	10.2903445	0.00544	15.47191	15.49720	0.02529	12.30351	15.47191	0.016079	0.398192
2009	228600	5513129	12.33973	12.30351	0.07500	29920	10.3062956	0.00467	15.49720	15.52264	0.02544	12.33973	15.49720	0.016079	0.398192
2010	236894	5655895	12.37537	12.33973	0.07500	30401	10.3222467	0.00428	15.52264	15.54821	0.02557	12.37537	15.52264	0.016079	0.398192
2011	245504	5803039	12.41107	12.37537	0.07500	30890	10.3381978	0.00421	15.54821	15.57389	0.02568	12.41107	15.54821	0.016079	0.398192
2012	253818	5954092	12.44437	12.41107	0.07500	31387	10.3541489	0.00266	15.57389	15.59959	0.02570	12.44437	15.57389	0.016079	0.398192
2013	262208	6108957	12.47689	12.44437	0.07500	31892	10.3701	0.00167	15.59959	15.62527	0.02568	12.47689	15.59959	0.016079	0.398192
2014	270993	6267846	12.50985	12.47689	0.07500	32404	10.3860511	0.00129	15.62527	15.65094	0.02568	12.50985	15.62527	0.016079	0.398192
2015	280441	6431211	12.54412	12.50985	0.07500	32925	10.4020022	0.00154	15.65094	15.67667	0.02573	12.54412	15.65094	0.016079	0.398192
2016	289935	6598902	12.57741	12.54412	0.07500	33455	10.4179533	0.00062	15.67667	15.70241	0.02574	12.57741	15.67667	0.016079	0.398192

Table D-20
Housing Stock and Price Forecasts
Ontario

Ontario

1998-2016

Medium/Medium Scenario: Medium Economic Growth and Medium Demographic Growth

1- GDP growth per adult = 1.60790
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 2 from Statistics Canada (medium growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		4144328								15.23725					
1997	120766	4198891	11.70161			24708		0.01554	15.23725	15.25033	0.01308	11.70161	15.23725	0.016079	
1998	133343	4268278	11.80068	11.70161	0.07500	25105	10.1308335	0.01693	15.25033	15.26672	0.01639	11.80068	15.25033	0.016079	0.398192
1999	144951	4349814	11.88415	11.80068	0.07500	25509	10.1467846	0.01598	15.26672	15.28564	0.01892	11.88415	15.26672	0.016079	0.398192
2000	155966	4441761	11.95739	11.88415	0.07500	25919	10.1627357	0.01628	15.28564	15.30656	0.02092	11.95739	15.28564	0.016079	0.398192
2001	165853	4542065	12.01886	11.95739	0.07500	26336	10.1786868	0.01434	15.30656	15.32889	0.02233	12.01886	15.30656	0.016079	0.398192
2002	173974	4648268	12.06666	12.01886	0.07500	26759	10.1946379	0.00949	15.32889	15.35201	0.02311	12.06666	15.32889	0.016079	0.398192
2003	182251	4760226	12.11314	12.06666	0.07500	27190	10.210589	0.01004	15.35201	15.37581	0.02380	12.11314	15.35201	0.016079	0.398192
2004	190695	4877821	12.15843	12.11314	0.07500	27627	10.2265401	0.01065	15.37581	15.40021	0.02440	12.15843	15.37581	0.016079	0.398192
2005	199250	5000889	12.20232	12.15843	0.07500	28071	10.2424912	0.01109	15.40021	15.42513	0.02492	12.20232	15.40021	0.016079	0.398192
2006	207753	5129120	12.24411	12.20232	0.07500	28522	10.2584423	0.01101	15.42513	15.45044	0.02532	12.24411	15.42513	0.016079	0.398192
2007	216243	5262263	12.28416	12.24411	0.07500	28981	10.2743934	0.01088	15.45044	15.47607	0.02563	12.28416	15.45044	0.016079	0.398192
2008	224682	5400052	12.32244	12.28416	0.07500	29447	10.2903445	0.01052	15.47607	15.50192	0.02585	12.32244	15.47607	0.016079	0.398192
2009	232978	5542145	12.35870	12.32244	0.07500	29920	10.3062956	0.00973	15.50192	15.52789	0.02597	12.35870	15.50192	0.016079	0.398192
2010	241362	5688444	12.39405	12.35870	0.07500	30401	10.3222467	0.00930	15.52789	15.55395	0.02606	12.39405	15.52789	0.016079	0.398192
2011	250001	5839013	12.42922	12.39405	0.07500	30890	10.3381978	0.00918	15.55395	15.58007	0.02613	12.42922	15.55395	0.016079	0.398192
2012	258322	5993372	12.46196	12.42922	0.07500	31387	10.3541489	0.00765	15.58007	15.60616	0.02609	12.46196	15.58007	0.016079	0.398192
2013	266703	6151414	12.49389	12.46196	0.07500	31892	10.3701	0.00667	15.60616	15.63219	0.02603	12.49389	15.60616	0.016079	0.398192
2014	275460	6313335	12.52620	12.49389	0.07500	32404	10.3860511	0.00625	15.63219	15.65817	0.02598	12.52620	15.63219	0.016079	0.398192
2015	284850	6479560	12.55972	12.52620	0.07500	32925	10.4020022	0.00642	15.65817	15.68416	0.02599	12.55972	15.65817	0.016079	0.398192
2016	294294	6649957	12.59233	12.55972	0.07500	33455	10.4179533	0.00549	15.68416	15.71012	0.02596	12.59233	15.68416	0.016079	0.398192

Table D-21
Housing Stock and Price Forecasts
Ontario

Ontario

1998-2016

Medium/Strong Scenario: Medium Economic Growth and Strong Demographic Growth

1- GDP growth per adult = 1.60790
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 3 from Statistics Canada (strong growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and older
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Year	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25,54)t	Dt-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	N(25,54)t
1996		4144328								15.23725					
1997	120766	4198891	11.70161			24708		0.01554	15.23725	15.25033	0.01308	11.70161	15.23725	0.016079	
1998	133473	4268448	11.80165	11.70161	0.07500	25105	10.13083	0.01754	15.25033	15.26676	0.01643	11.80165	15.25033	0.016079	0.398192
1999	145158	4350233	11.88558	11.80165	0.07500	25509	10.14678	0.01645	15.26676	15.28574	0.01898	11.88558	15.26676	0.016079	0.398192
2000	156212	4442453	11.95897	11.88558	0.07500	25919	10.16274	0.01667	15.28574	15.30672	0.02098	11.95897	15.28574	0.016079	0.398192
2001	166540	4543504	12.02299	11.95897	0.07500	26336	10.17869	0.01628	15.30672	15.32921	0.02249	12.02299	15.30672	0.016079	0.398192
2002	175012	4650797	12.07261	12.02299	0.07500	26759	10.19464	0.01149	15.32921	15.35255	0.02334	12.07261	15.32921	0.016079	0.398192
2003	183555	4764069	12.12027	12.07261	0.07500	27190	10.21059	0.01206	15.35255	15.37661	0.02406	12.12027	15.35255	0.016079	0.398192
2004	192188	4883111	12.16623	12.12027	0.07500	27627	10.22654	0.01265	15.37661	15.40129	0.02468	12.16623	15.37661	0.016079	0.398192
2005	200870	5007687	12.21041	12.16623	0.07500	28071	10.24249	0.01308	15.40129	15.42648	0.02519	12.21041	15.40129	0.016079	0.398192
2006	209760	5137746	12.25372	12.21041	0.07500	28522	10.25844	0.01389	15.42648	15.45213	0.02564	12.25372	15.42648	0.016079	0.398192
2007	218496	5272885	12.29452	12.25372	0.07500	28981	10.27439	0.01368	15.45213	15.47809	0.02596	12.29452	15.45213	0.016079	0.398192
2008	227092	5412742	12.33311	12.29452	0.07500	29447	10.29034	0.01328	15.47809	15.50427	0.02618	12.33311	15.47809	0.016079	0.398192
2009	235486	5556920	12.36941	12.33311	0.07500	29920	10.3063	0.01248	15.50427	15.53055	0.02629	12.36941	15.50427	0.016079	0.398192
2010	243909	5705262	12.40455	12.36941	0.07500	30401	10.32225	0.01201	15.53055	15.55690	0.02634	12.40455	15.53055	0.016079	0.398192
2011	252556	5857806	12.43939	12.40455	0.07500	30890	10.3382	0.01187	15.55690	15.58329	0.02639	12.43939	15.55690	0.016079	0.398192
2012	260871	6014062	12.47178	12.43939	0.07500	31387	10.35415	0.01035	15.58329	15.60961	0.02633	12.47178	15.58329	0.016079	0.398192
2013	269233	6173917	12.50333	12.47178	0.07500	31892	10.3701	0.00936	15.60961	15.63584	0.02623	12.50333	15.60961	0.016079	0.398192
2014	277960	6337559	12.53523	12.50333	0.07500	32404	10.38605	0.00892	15.63584	15.66200	0.02616	12.53523	15.63584	0.016079	0.398192
2015	287289	6505383	12.56824	12.53523	0.07500	32925	10.402	0.00900	15.66200	15.68814	0.02614	12.56824	15.66200	0.016079	0.398192
2016	296679	6677270	12.60041	12.56824	0.07500	33455	10.41795	0.00806	15.68814	15.71422	0.02608	12.60041	15.68814	0.016079	0.398192

Table D-22
Housing Stock and Price Forecasts
Manitoba

Programming: Mario Fortin and André Leclerc

Manitoba

1998-2016

Weak/Weak Scenario: Weak Economic Growth and Weak Demographic Growth

1- GDP growth per adult = 1 00000
2- Five-year mortgage loan interest rate = 7 50
3- Demographic projections = scenario 1 from Statistics Canada (weak growth)

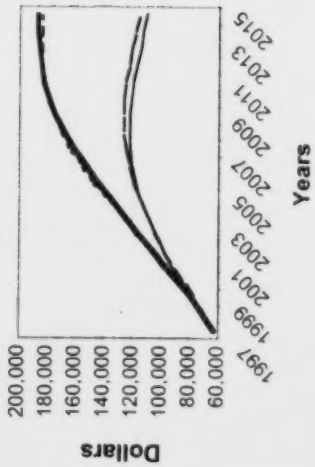
Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		439148								12 99259					
1997	62744	442175	11 04682			21523		0 00815	12 99259	12 99946	0 00687	11 04682	12 99259	0 01	
1998	70312	446519	11 16070	11 04682	0 07500	21738	9 986828	0 00569	12 99946	13 00924	0 00978	11 16070	12 99946	0 01	0 693326
1999	78276	452151	11 26800	11 16070	0 07500	21956	9 996778	0 00537	13 00924	13 02177	0 01254	11 26800	13 00924	0 01	0 693326
2000	86617	459033	11 36925	11 26800	0 07500	22175	10 00673	0 00568	13 02177	13 03688	0 01511	11 36925	13 02177	0 01	0 693326
2001	94378	466961	11 45506	11 36925	0 07500	22397	10 01668	0 00323	13 03688	13 05400	0 01712	11 45506	13 03688	0 01	0 693326
2002	100370	475572	11 51662	11 45506	0 07500	22621	10 02663	-0 00208	13 05400	13 07227	0 01827	11 51662	13 05400	0 01	0 693326
2003	105969	484775	11 57091	11 51662	0 07500	22847	10 03658	-0 00177	13 07227	13 09144	0 01917	11 57091	13 07227	0 01	0 693326
2004	111159	494483	11 61871	11 57091	0 07500	23076	10 04653	-0 00114	13 09144	13 11127	0 01983	11 61871	13 09144	0 01	0 693326
2005	115468	504544	11 65675	11 61871	0 07500	23306	10 05648	-0 00161	13 11127	13 13141	0 02014	11 65675	13 11127	0 01	0 693326
2006	118910	514817	11 68612	11 65675	0 07500	23539	10 06643	-0 00180	13 13141	13 15157	0 02016	11 68612	13 13141	0 01	0 693326
2007	121325	525144	11 70623	11 68612	0 07500	23775	10 07638	-0 00234	13 15157	13 17143	0 01986	11 70623	13 15157	0 01	0 693326
2008	122818	535384	11 71846	11 70623	0 07500	24013	10 08633	-0 00263	13 17143	13 19074	0 01931	11 71846	13 17143	0 01	0 693326
2009	123144	545362	11 72111	11 71846	0 07500	24253	10 09628	-0 00375	13 19074	13 20920	0 01846	11 72111	13 19074	0 01	0 693326
2010	122697	554957	11 71747	11 72111	0 07500	24495	10 10623	-0 00408	13 20920	13 22665	0 01744	11 71747	13 20920	0 01	0 693326
2011	121753	564093	11 70975	11 71747	0 07500	24740	10 11618	-0 00399	13 22665	13 24297	0 01633	11 70975	13 22665	0 01	0 693326
2012	120004	572639	11 69528	11 70975	0 07500	24988	10 12613	-0 00510	13 24297	13 25801	0 01504	11 69528	13 24297	0 01	0 693326
2013	117628	580490	11 67528	11 69528	0 07500	25237	10 13608	-0 00618	13 25801	13 27163	0 01362	11 67528	13 25801	0 01	0 693326
2014	115217	587638	11 65458	11 67528	0 07500	25490	10 14603	-0 00600	13 27163	13 28387	0 01224	11 65458	13 27163	0 01	0 693326
2015	112764	594080	11 63305	11 65458	0 07500	25745	10 15598	-0 00617	13 28387	13 29477	0 01090	11 63305	13 28387	0 01	0 693326
2016	110345	599824	11 61136	11 63305	0 07500	26002	10 16593	-0 00640	13 29477	13 30439	0 00962	11 61136	13 29477	0 01	0 693326

Table D-23
Housing Stock and Price Forecasts
Manitoba

Comparison of Results

Housing Prices According to Scenario



Housing Stock According to Scenario

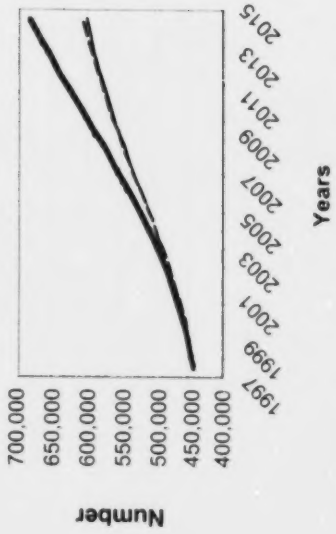


Table D-24
Housing Stock and Price Forecasts
Manitoba

Manitoba

1998-2016

Weak/Medium Scenario: Weak Economic Growth and Medium Demographic Growth

1- GDP growth per adult = 1.00000
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 2 from Statistics Canada (medium growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		439148								12.99259					
1997	62744	442175	11.04682			21523		0.00815	12.99259	12.99946	0.00687	11.04682	12.99259	0.01	
1998	70533	446568	11.16384	11.04682	0.07500	21738	9.98683	0.00676	12.99946	13.00935	0.00988	11.16384	12.99946	0.01	0.69333
1999	78756	452294	11.27411	11.16384	0.07500	21956	9.99678	0.00646	13.00935	13.02209	0.01274	11.27411	13.00935	0.01	0.69333
2000	87391	459314	11.37814	11.27411	0.07500	22175	10.0067	0.00680	13.02209	13.03749	0.01540	11.37814	13.02209	0.01	0.69333
2001	95660	467451	11.46855	11.37814	0.07500	22397	10.0167	0.00508	13.03749	13.05505	0.01756	11.46855	13.03749	0.01	0.69333
2002	102171	476342	11.53440	11.46855	0.07500	22621	10.0266	-0.00016	13.05505	13.07389	0.01884	11.53440	13.05505	0.01	0.69333
2003	108288	485888	11.59255	11.53440	0.07500	22847	10.0366	0.00018	13.07389	13.09373	0.01984	11.59255	13.07389	0.01	0.69333
2004	113973	495995	11.64372	11.59255	0.07500	23076	10.0465	0.00085	13.09373	13.11432	0.02059	11.64372	13.09373	0.01	0.69333
2005	118732	506503	11.68462	11.64372	0.07500	23306	10.0565	0.00043	13.11432	13.13528	0.02096	11.68462	13.11432	0.01	0.69333
2006	122806	517299	11.71836	11.68462	0.07500	23539	10.0664	0.00097	13.13528	13.15638	0.02109	11.71836	13.13528	0.01	0.69333
2007	125769	528214	11.74220	11.71836	0.07500	23775	10.0764	0.00048	13.15638	13.17726	0.02088	11.74220	13.15638	0.01	0.69333
2008	127713	539096	11.75754	11.74220	0.07500	24013	10.0863	0.00026	13.17726	13.19765	0.02039	11.75754	13.17726	0.01	0.69333
2009	128371	549754	11.76268	11.75754	0.07500	24253	10.0963	-0.00080	13.19765	13.21723	0.01958	11.76268	13.19765	0.01	0.69333
2010	128139	560055	11.76087	11.76268	0.07500	24495	10.1062	-0.00108	13.21723	13.23579	0.01857	11.76087	13.21723	0.01	0.69333
2011	127300	569907	11.75430	11.76087	0.07500	24740	10.1162	-0.00095	13.23579	13.25323	0.01744	11.75430	13.23579	0.01	0.69333
2012	125548	579166	11.74044	11.75430	0.07500	24988	10.1261	-0.00200	13.25323	13.26934	0.01611	11.74044	13.25323	0.01	0.69333
2013	123076	587710	11.72056	11.74044	0.07500	25237	10.1361	-0.00302	13.26934	13.28399	0.01465	11.72056	13.26934	0.01	0.69333
2014	120499	595522	11.69940	11.72056	0.07500	25490	10.146	-0.00282	13.28399	13.29719	0.01320	11.69940	13.28399	0.01	0.69333
2015	117825	602584	11.67696	11.69940	0.07500	25745	10.156	-0.00295	13.29719	13.30898	0.01179	11.67696	13.29719	0.01	0.69333
2016	115139	608895	11.65390	11.67696	0.07500	26002	10.1659	-0.00317	13.30898	13.31940	0.01042	11.65390	13.30898	0.01	0.69333

Table D-25
Housing Stock and Price Forecasts
Manitoba

[redacted]

1998-2016

[redacted]

1- GDP growth per adult = 1.00000
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 3 from Statistics Canada (strong growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation												
		[redacted]													
1996		439148													
1997	62744	442175	11.04682			21523		0.00815	12.99259	12.99259	0.00687	11.04682	12.99259	0.01	
1998	70122	446477	11.15800	11.04682	0.07500	21738	9.986828	0.00477	12.99946	12.99946	0.00968	11.15800	12.99946	0.01	0.693326
1999	77821	452019	11.26216	11.15800	0.07500	21956	9.996778	0.00423	13.00914	13.00914	0.01234	11.26216	13.00914	0.01	0.693326
2000	85808	458756	11.35987	11.26216	0.07500	22175	10.00673	0.00432	13.02148	13.02148	0.01479	11.35987	13.02148	0.01	0.693326
2001	93601	466558	11.44679	11.35987	0.07500	22397	10.01668	0.00332	13.03627	13.03627	0.01686	11.44679	13.03627	0.01	0.693326
2002	99691	475069	11.50983	11.44679	0.07500	22621	10.02663	-0.00189	13.05314	13.05314	0.01808	11.50983	13.05314	0.01	0.693326
2003	105436	484202	11.56586	11.50983	0.07500	22847	10.03658	-0.00152	13.07122	13.07122	0.01904	11.56586	13.07122	0.01	0.693326
2004	110838	493877	11.61582	11.56586	0.07500	23076	10.04653	-0.00074	13.09026	13.09026	0.01978	11.61582	13.09026	0.01	0.693326
2005	115469	503956	11.65675	11.61582	0.07500	23306	10.05648	-0.00092	13.11004	13.11004	0.02020	11.65675	13.11004	0.01	0.693326
2006	119685	514362	11.69262	11.65675	0.07500	23539	10.06643	0.00017	13.13024	13.13024	0.02044	11.69262	13.13024	0.01	0.693326
2007	122929	524941	11.71936	11.69262	0.07500	23775	10.07638	-0.00015	13.15068	13.15068	0.02036	11.71936	13.15068	0.01	0.693326
2008	125244	535552	11.73802	11.71936	0.07500	24013	10.08633	-0.00029	13.17104	13.17104	0.02001	11.73802	13.17104	0.01	0.693326
2009	126354	546012	11.74684	11.73802	0.07500	24253	10.09628	-0.00124	13.19105	13.19105	0.01934	11.74684	13.19105	0.01	0.693326
2010	126641	556199	11.74911	11.74684	0.07500	24495	10.10623	-0.00138	13.21040	13.21040	0.01848	11.74911	13.21040	0.01	0.693326
2011	126368	566026	11.74696	11.74911	0.07500	24740	10.11618	-0.00108	13.22888	13.22888	0.01752	11.74696	13.22888	0.01	0.693326
2012	125199	575355	11.73766	11.74696	0.07500	24988	10.12613	-0.00199	13.24640	13.24640	0.01635	11.73766	13.24640	0.01	0.693326
2013	123310	584067	11.72246	11.73766	0.07500	25237	10.13608	-0.00284	13.26274	13.26274	0.01503	11.72246	13.26274	0.01	0.693326
2014	121225	592131	11.70541	11.72246	0.07500	25490	10.14603	-0.00268	13.27777	13.27777	0.01371	11.70541	13.27777	0.01	0.693326
2015	118965	599517	11.68658	11.70541	0.07500	25745	10.15598	-0.00280	13.29148	13.29148	0.01240	11.68658	13.29148	0.01	0.693326
2016	116642	606218	11.66687	11.68658	0.07500	26002	10.16593	-0.00292	13.30388	13.30388	0.01111	11.66687	13.30388	0.01	0.693326

Table D-26
Housing Stock and Price Forecasts
Manitoba

Manitoba

1998-2016

Medium/Weak Scenario: Medium Economic Growth and Weak Demographic Growth

1- GDP growth per adult = 1.96020
2- Five-year mortgage laon interest rate = 7.50
3- Demographic projections = scenario 1 from Statistics Canada (weak growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		439148								12.99259					
1997	62744	442175	11.04682			21523		0.00815	12.99259	12.99946	0.00687	11.04682	12.99259	0.019602	
1998	70717	446648	11.16645	11.04682	0.07500	21945	9.99628976	0.00569	12.99946	13.00953	0.01007	11.16645	12.99946	0.019602	0.693326
1999	79600	452609	11.28477	11.16645	0.07500	22375	10.0157021	0.00537	13.00953	13.02278	0.01326	11.28477	13.00953	0.019602	0.693326
2000	89483	460086	11.40180	11.28477	0.07500	22814	10.0351145	0.00568	13.02278	13.03917	0.01638	11.40180	13.02278	0.019602	0.693326
2001	99466	468941	11.50758	11.40180	0.07500	23261	10.0545268	0.00323	13.03917	13.05823	0.01906	11.50758	13.03917	0.019602	0.693326
2002	108299	478874	11.59265	11.50758	0.07500	23717	10.0739392	-0.00208	13.05823	13.07919	0.02096	11.59265	13.05823	0.019602	0.693326
2003	117404	489848	11.67338	11.59265	0.07500	24182	10.0933515	-0.00177	13.07919	13.10185	0.02266	11.67338	13.07919	0.019602	0.693326
2004	126744	501828	11.74993	11.67338	0.07500	24656	10.1127639	-0.00114	13.10185	13.12601	0.02416	11.74993	13.10185	0.019602	0.693326
2005	135723	514702	11.81837	11.74993	0.07500	25139	10.1321763	-0.00161	13.12601	13.15134	0.02533	11.81837	13.12601	0.019602	0.693326
2006	144236	528363	11.87921	11.81837	0.07500	25632	10.1515886	-0.00180	13.15134	13.17754	0.02620	11.87921	13.15134	0.019602	0.693326
2007	151945	542673	11.93128	11.87921	0.07500	26134	10.171001	-0.00234	13.17754	13.20426	0.02672	11.93128	13.17754	0.019602	0.693326
2008	158806	557501	11.97544	11.93128	0.07500	26647	10.1904133	-0.00263	13.20426	13.23122	0.02696	11.97544	13.20426	0.019602	0.693326
2009	164310	572665	12.00951	11.97544	0.07500	27169	10.2098257	-0.00375	13.23122	13.25806	0.02684	12.00951	13.23122	0.019602	0.693326
2010	168784	588028	12.03637	12.00951	0.07500	27701	10.229238	-0.00408	13.25806	13.28453	0.02647	12.03637	13.25806	0.019602	0.693326
2011	172452	603483	12.05788	12.03637	0.07500	28244	10.2486504	-0.00399	13.28453	13.31047	0.02594	12.05788	13.28453	0.019602	0.693326
2012	174742	618854	12.07107	12.05788	0.07500	28798	10.2680627	-0.00510	13.31047	13.33563	0.02515	12.07107	13.31047	0.019602	0.693326
2013	175771	633978	12.07694	12.07107	0.07500	29363	10.2874751	-0.00618	13.33563	13.35977	0.02414	12.07694	13.33563	0.019602	0.693326
2014	176337	648790	12.08015	12.07694	0.07500	29938	10.3068874	-0.00600	13.35977	13.38286	0.02309	12.08015	13.35977	0.019602	0.693326
2015	176398	663219	12.08050	12.08015	0.07500	30525	10.3262998	-0.00617	13.38286	13.40486	0.02200	12.08050	13.38286	0.019602	0.693326
2016	176061	677206	12.07859	12.08050	0.07500	31123	10.3457122	-0.00640	13.40486	13.42573	0.02087	12.07859	13.40486	0.019602	0.693326

Table D-27
Housing Stock and Price Forecasts
Manitoba

[redacted]

Manitoba

1998-2016

Medium/Medium Scenario: Medium Economic Growth and Medium Demographic Growth

1- GDP growth per adult = 1.96020
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 2 from Statistics Canada (medium growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		439148								12.99259					
1997	62744	442175	11.04682			21523		0.00815	12.99259	12.99946	0.00687	11.04682	12.99259	0.019602	
1998	70940	446697	11.16959	11.04682	0.07500	21945	9.99628976	0.00676	12.99946	13.00964	0.01017	11.16959	12.99946	0.019602	0.693326
1999	80088	452752	11.29089	11.16959	0.07500	22375	10.0157021	0.00646	13.00964	13.02310	0.01346	11.29089	13.00964	0.019602	0.693326
2000	90282	460367	11.41070	11.29089	0.07500	22814	10.0351145	0.00680	13.02310	13.03978	0.01668	11.41070	13.02310	0.019602	0.693326
2001	100817	469434	11.52106	11.41070	0.07500	23261	10.0545268	0.00508	13.03978	13.05928	0.01950	11.52106	13.03978	0.019602	0.693326
2002	110242	479650	11.61043	11.52106	0.07500	23717	10.0739392	-0.00016	13.05928	13.08081	0.02153	11.61043	13.05928	0.019602	0.693326
2003	119973	490973	11.69502	11.61043	0.07500	24182	10.0933515	0.00018	13.08081	13.10414	0.02333	11.69502	13.08081	0.019602	0.693326
2004	129953	503362	11.77493	11.69502	0.07500	24656	10.1127639	0.00085	13.10414	13.12906	0.02492	11.77493	13.10414	0.019602	0.693326
2005	139559	516700	11.84624	11.77493	0.07500	25139	10.1321763	0.00043	13.12906	13.15522	0.02615	11.84624	13.12906	0.019602	0.693326
2006	148962	530910	11.91145	11.84624	0.07500	25632	10.1515886	0.00097	13.15522	13.18235	0.02713	11.91145	13.15522	0.019602	0.693326
2007	157511	545845	11.96725	11.91145	0.07500	26134	10.171001	0.00048	13.18235	13.21009	0.02774	11.96725	13.18235	0.019602	0.693326
2008	165136	561366	12.01452	11.96725	0.07500	26647	10.1904133	0.00026	13.21009	13.23813	0.02804	12.01452	13.21009	0.019602	0.693326
2009	171284	577277	12.05108	12.01452	0.07500	27169	10.2098257	-0.00080	13.23813	13.26608	0.02795	12.05108	13.23813	0.019602	0.693326
2010	176270	593430	12.07977	12.05108	0.07500	27701	10.229238	-0.00108	13.26608	13.29367	0.02760	12.07977	13.26608	0.019602	0.693326
2011	180310	609703	12.10243	12.07977	0.07500	28244	10.2486504	-0.00095	13.29367	13.32073	0.02705	12.10243	13.29367	0.019602	0.693326
2012	182816	625907	12.11623	12.10243	0.07500	28798	10.2680627	-0.00200	13.32073	13.34696	0.02623	12.11623	13.32073	0.019602	0.693326
2013	183913	641864	12.12222	12.11623	0.07500	29363	10.2874751	-0.00302	13.34696	13.37213	0.02517	12.12222	13.34696	0.019602	0.693326
2014	184421	657494	12.12498	12.12222	0.07500	29938	10.3068874	-0.00282	13.37213	13.39619	0.02406	12.12498	13.37213	0.019602	0.693326
2015	184316	672712	12.12440	12.12498	0.07500	30525	10.3262998	-0.00295	13.39619	13.41907	0.02288	12.12440	13.39619	0.019602	0.693326
2016	183711	687447	12.12112	12.12440	0.07500	31123	10.3457122	-0.00317	13.41907	13.44074	0.02167	12.12112	13.41907	0.019602	0.693326

Table D-28
Housing Stock and Price Forecasts
Manitoba

[redacted]

Manitoba

1998-2016

Medium/Strong Scenario: Medium Economic Growth and Strong Demographic Growth

1- GDP growth per adult = 1.96020
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 3 of Statistics Canada (strong growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	/ar N(25, 54)	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		439148								12.99259					
1997	62744	442175	11.04682			21523		0.00815	12.99259	12.99946	0.00687	11.04682	12.99259	0.019602	
1998	70527	446606	11.16374	11.04682	0.07500	21945	9.99629	0.00477	12.99946	13.00943	0.00997	11.16374	12.99946	0.019602	0.693326
1999	79137	452477	11.27894	11.16374	0.07500	22375	10.0157	0.00423	13.00943	13.02249	0.01306	11.27894	13.00943	0.019602	0.693326
2000	88648	459808	11.39242	11.27894	0.07500	22814	10.03511	0.00432	13.02249	13.03856	0.01607	11.39242	13.02249	0.019602	0.693326
2001	98647	468537	11.49930	11.39242	0.07500	23261	10.05453	0.00332	13.03856	13.05737	0.01881	11.49930	13.03856	0.019602	0.693326
2002	107566	478368	11.58586	11.49930	0.07500	23717	10.07394	-0.00189	13.05737	13.07814	0.02077	11.58586	13.05737	0.019602	0.693326
2003	116813	489270	11.66833	11.58586	0.07500	24182	10.09335	-0.00152	13.07814	13.10067	0.02253	11.66833	13.07814	0.019602	0.693326
2004	126379	501213	11.74704	11.66833	0.07500	24656	10.11276	-0.00074	13.10067	13.12479	0.02412	11.74704	13.10067	0.019602	0.693326
2005	135723	514101	11.81837	11.74704	0.07500	25139	10.13218	-0.00092	13.12479	13.15018	0.02539	11.81837	13.12479	0.019602	0.693326
2006	145176	527895	11.88571	11.81837	0.07500	25632	10.15159	0.00017	13.15018	13.17665	0.02648	11.88571	13.15018	0.019602	0.693326
2007	153954	542463	11.94441	11.88571	0.07500	26134	10.171	-0.00015	13.17665	13.20388	0.02722	11.94441	13.17665	0.019602	0.693326
2008	161943	557676	11.99500	11.94441	0.07500	26647	10.19041	-0.00029	13.20388	13.23153	0.02766	11.99500	13.20388	0.019602	0.693326
2009	168593	573348	12.03524	11.99500	0.07500	27169	10.20983	-0.00124	13.23153	13.25925	0.02772	12.03524	13.23153	0.019602	0.693326
2010	174209	589344	12.06801	12.03524	0.07500	27701	10.22924	-0.00138	13.25925	13.28677	0.02752	12.06801	13.25925	0.019602	0.693326
2011	178990	605551	12.09508	12.06801	0.07500	28244	10.24865	-0.00108	13.28677	13.31389	0.02713	12.09508	13.28677	0.019602	0.693326
2012	182308	621789	12.11345	12.09508	0.07500	28798	10.26806	-0.00199	13.31389	13.34036	0.02646	12.11345	13.31389	0.019602	0.693326
2013	184263	637885	12.12412	12.11345	0.07500	29363	10.28748	-0.00284	13.34036	13.36591	0.02556	12.12412	13.34036	0.019602	0.693326
2014	185532	653750	12.13098	12.12412	0.07500	29938	10.30689	-0.00268	13.36591	13.39048	0.02457	12.13098	13.36591	0.019602	0.693326
2015	186098	669289	12.13403	12.13098	0.07500	30525	10.3263	-0.00280	13.39048	13.41397	0.02349	12.13403	13.39048	0.019602	0.693326
2016	186109	684425	12.13409	12.13403	0.07500	31123	10.34571	-0.00292	13.41397	13.43633	0.02236	12.13409	13.41397	0.019602	0.693326

Table D-29
Housing Stock and Price Forecasts
Saskatchewan

[redacted]

Programming: Mario Fortin and André Leclerc

1998-2016

[redacted]

1- GDP growth per adult = 1.00000
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 1 from Statistics Canada (weak growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

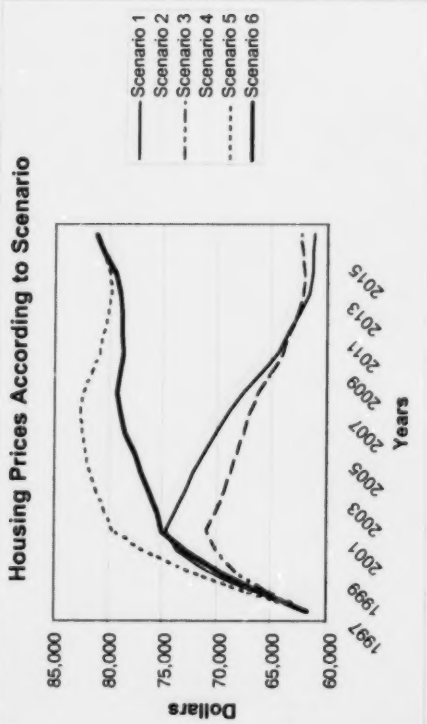
	Forecasts		Price Equation													
1996		396044														
1997	61696	398421	11.02997			25413		0.00770	12.88928	12.88928						
1998	66904	402804	11.11102	11.02997	0.07500	25667	10.15297	0.00353	12.89526	12.89526	0.00598	11.02997	12.88928	0.01		
1999	70866	408220	11.16855	11.11102	0.07500	25924	10.16292	0.00372	12.90621	12.90621	0.01094	11.11102	12.89526	0.01	0.122617	
2000	73626	414256	11.20675	11.16855	0.07500	26183	10.17287	0.00381	12.91956	12.91956	0.01336	11.16855	12.90621	0.01	0.122617	
2001	74794	420493	11.22250	11.20675	0.07500	26445	10.18282	0.00220	12.93424	12.93424	0.01468	11.20675	12.91956	0.01	0.122617	
2002	73913	426412	11.21064	11.22250	0.07500	26709	10.19277	-0.00193	12.94918	12.94918	0.01494	11.22250	12.93424	0.01	0.122617	
2003	73017	432002	11.19845	11.21064	0.07500	26976	10.20272	-0.00162	12.96316	12.96316	0.01398	11.21064	12.94918	0.01	0.122617	
2004	72139	437263	11.18635	11.19845	0.07500	27246	10.21267	-0.00138	12.97619	12.97619	0.01302	11.19845	12.96316	0.01	0.122617	
2005	71153	442160	11.17259	11.18635	0.07500	27519	10.22262	-0.00168	12.98829	12.98829	0.01210	11.18635	12.97619	0.01	0.122617	
2006	70053	446657	11.15701	11.17259	0.07500	27794	10.23257	-0.00226	12.99943	12.99943	0.01114	11.17259	12.98829	0.01	0.122617	
2007	68871	450724	11.13999	11.15701	0.07500	28072	10.24252	-0.00303	13.00955	13.00955	0.01012	11.15701	12.99943	0.01	0.122617	
2008	67529	454310	11.12031	11.13999	0.07500	28352	10.25247	-0.00432	13.01861	13.01861	0.00906	11.13999	13.00955	0.01	0.122617	
2009	66003	457354	11.09746	11.12031	0.07500	28636	10.26242	-0.00607	13.02653	13.02653	0.00792	11.12031	13.01861	0.01	0.122617	
2010	64518	459863	11.07471	11.09746	0.07500	28922	10.27237	-0.00744	13.03321	13.03321	0.00668	11.09746	13.02653	0.01	0.122617	
2011	63537	461998	11.05938	11.07471	0.07500	29212	10.28232	-0.00732	13.03868	13.03868	0.00547	11.07471	13.03321	0.01	0.122617	
2012	62509	463744	11.04307	11.05938	0.07500	29504	10.29227	-0.00880	13.04332	13.04332	0.00463	11.05938	13.03868	0.01	0.122617	
2013	61694	465174	11.02993	11.04307	0.07500	29799	10.30222	-0.00951	13.04709	13.04709	0.00377	11.04307	13.04332	0.01	0.122617	
2014	61285	466428	11.02329	11.02993	0.07500	30097	10.31217	-0.00938	13.05017	13.05017	0.00308	11.02993	13.04709	0.01	0.122617	
2015	61296	467653	11.02347	11.02329	0.07500	30398	10.32212	-0.00883	13.05286	13.05286	0.00269	11.02329	13.05017	0.01	0.122617	
2016	61233	468823	11.02244	11.02347	0.07500	30702	10.33207	-0.00972	13.05548	13.05548	0.00262	11.02347	13.05286	0.01	0.122617	
										13.05798	0.00250	11.02244	13.05548	0.01	0.122617	

Table D-30

Housing Stock and Price Forecasts

Saskatchewan

Comparison of Results



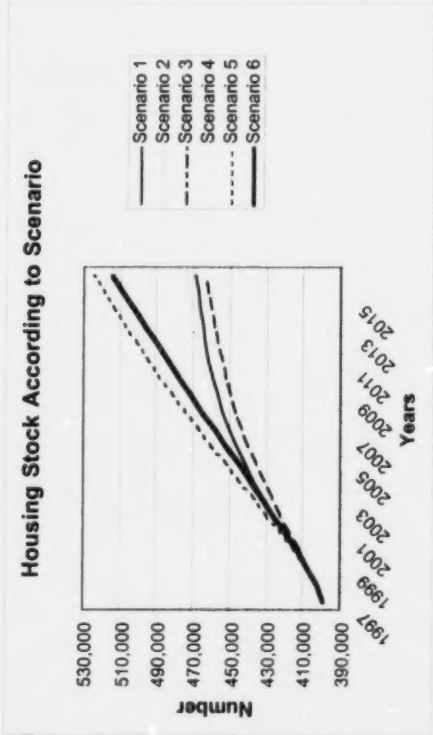


Table D-31
Housing Stock and Price Forecasts
Saskatchewan

Saskatchewan

1998-2016

Weak/Medium Scenario: Weak Economic Growth and Medium Demographic Growth

1- GDP growth per adult = 1.00000
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 2 from Statistics Canada (medium growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equations								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	A(t-1)
1996		396044								12.88928					
1997	61696	398421	11.02997			25413		0.00770	12.88928	12.89526	0.00598	11.02997	12.88928	0.01	
1998	67088	402853	11.11376	11.02997	0.07500	25667	10.153	0.00416	12.89526	12.90633	0.01106	11.11376	12.89526	0.01	0.122617
1999	71209	408355	11.17338	11.11376	0.07500	25924	10.1629	0.00439	12.90633	12.91989	0.01357	11.17338	12.90633	0.01	0.122617
2000	74095	414506	11.21310	11.17338	0.07500	26183	10.1729	0.00450	12.91989	12.93484	0.01495	11.21310	12.91989	0.01	0.122617
2001	75480	420909	11.23162	11.21310	0.07500	26445	10.1828	0.00331	12.93484	12.95017	0.01533	11.23162	12.93484	0.01	0.122617
2002	74742	427033	11.22180	11.23162	0.07500	26709	10.1928	-0.00075	12.95017	12.96462	0.01444	11.22180	12.95017	0.01	0.122617
2003	73943	432855	11.21105	11.22180	0.07500	26976	10.2027	-0.00039	12.96462	12.97816	0.01354	11.21105	12.96462	0.01	0.122617
2004	73125	438364	11.19992	11.21105	0.07500	27246	10.2127	-0.00009	12.97816	12.99080	0.01265	11.19992	12.97816	0.01	0.122617
2005	72164	443517	11.18669	11.19992	0.07500	27519	10.2226	-0.00035	12.99080	13.00249	0.01169	11.18669	12.99080	0.01	0.122617
2006	71185	448305	11.17303	11.18669	0.07500	27794	10.2326	-0.00049	13.00249	13.01323	0.01074	11.17303	13.00249	0.01	0.122617
2007	70077	452686	11.15735	11.17303	0.07500	28072	10.2425	-0.00118	13.01323	13.02295	0.00973	11.15735	13.01323	0.01	0.122617
2008	68773	456599	11.13857	11.15735	0.07500	28352	10.2525	-0.00239	13.02295	13.03156	0.00861	11.13857	13.02295	0.01	0.122617
2009	67260	459974	11.11632	11.13857	0.07500	28636	10.2624	-0.00405	13.03156	13.03893	0.00737	11.11632	13.03156	0.01	0.122617
2010	65773	462815	11.09397	11.11632	0.07500	28922	10.2724	-0.00533	13.03893	13.04508	0.00616	11.09397	13.03893	0.01	0.122617
2011	64780	465275	11.07875	11.09397	0.07500	29212	10.2823	-0.00514	13.04508	13.05038	0.00530	11.07875	13.04508	0.01	0.122617
2012	63736	467338	11.06250	11.07875	0.07500	29504	10.2923	-0.00652	13.05038	13.05481	0.00442	11.06250	13.05038	0.01	0.122617
2013	62904	469076	11.04937	11.06250	0.07500	29799	10.3022	-0.00715	13.05481	13.05852	0.00371	11.04937	13.05481	0.01	0.122617
2014	62475	470626	11.04252	11.04937	0.07500	30097	10.3122	-0.00697	13.05852	13.06182	0.00330	11.04252	13.05852	0.01	0.122617
2015	62463	472131	11.04234	11.04252	0.07500	30398	10.3221	-0.00638	13.06182	13.06501	0.00319	11.04234	13.06182	0.01	0.122617
2016	62383	473569	11.04104	11.04234	0.07500	30702	10.3321	-0.00718	13.06501	13.06805	0.00304	11.04104	13.06501	0.01	0.122617

Table D-32
Housing Stock and Price Forecasts
Saskatchewan

[redacted]

Saskatchewan

1998-2016

Weak/Strong Scenario: Weak Economic Growth and Strong Demographic Growth

1- GDP growth per adult = 1.00000
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 3 from Statistics Canada (strong growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		396044								12.88928					
1997	61696	398421	11.02997			25413		0.00770	12.88928	12.89526	0.00598	11.02997	12.88928	0.01	
1998	65546	402438	11.09051	11.02997	0.07500	25667	10.15297	-0.00118	12.89526	12.90530	0.01003	11.09051	12.89526	0.01	0.122617
1999	68354	407208	11.13246	11.09051	0.07500	25924	10.16292	-0.00125	12.90530	12.91708	0.01178	11.13246	12.90530	0.01	0.122617
2000	70192	412386	11.15900	11.13246	0.07500	26183	10.17287	-0.00145	12.91708	12.92971	0.01263	11.15900	12.91708	0.01	0.122617
2001	71043	417697	11.17104	11.15900	0.07500	26445	10.18282	-0.00226	12.92971	12.94251	0.01280	11.17104	12.92971	0.01	0.122617
2002	70149	422680	11.15838	11.17104	0.07500	26709	10.19277	-0.00627	12.94251	12.95437	0.01186	11.15838	12.94251	0.01	0.122617
2003	69410	427372	11.14779	11.15838	0.07500	26976	10.20272	-0.00579	12.95437	12.96541	0.01104	11.14779	12.95437	0.01	0.122617
2004	68803	431808	11.13900	11.14779	0.07500	27246	10.21267	-0.00536	12.96541	12.97574	0.01032	11.13900	12.96541	0.01	0.122617
2005	68143	435970	11.12937	11.13900	0.07500	27519	10.22262	-0.00554	12.97574	12.98533	0.00959	11.12937	12.97574	0.01	0.122617
2006	67634	439901	11.12187	11.12937	0.07500	27794	10.23257	-0.00520	12.98533	12.99430	0.00898	11.12187	12.98533	0.01	0.122617
2007	67020	443570	11.11274	11.12187	0.07500	28072	10.24252	-0.00569	12.99430	13.00261	0.00831	11.11274	12.99430	0.01	0.122617
2008	66181	446911	11.10014	11.11274	0.07500	28352	10.25247	-0.00680	13.00261	13.01011	0.00750	11.10014	13.00261	0.01	0.122617
2009	65091	449846	11.08355	11.10014	0.07500	28636	10.26242	-0.00837	13.01011	13.01666	0.00655	11.08355	13.01011	0.01	0.122617
2010	63991	452371	11.06650	11.08355	0.07500	28922	10.27237	-0.00951	13.01666	13.02226	0.00560	11.06650	13.01666	0.01	0.122617
2011	63368	454638	11.05671	11.06650	0.07500	29212	10.28232	-0.00905	13.02226	13.02726	0.00500	11.05671	13.02226	0.01	0.122617
2012	62676	456627	11.04573	11.05671	0.07500	29504	10.29227	-0.01019	13.02726	13.03162	0.00436	11.04573	13.02726	0.01	0.122617
2013	62183	458405	11.03784	11.04573	0.07500	29799	10.30222	-0.01051	13.03162	13.03551	0.00389	11.03784	13.03162	0.01	0.122617
2014	62055	460094	11.03578	11.03784	0.07500	30097	10.31217	-0.01008	13.03551	13.03919	0.00368	11.03578	13.03551	0.01	0.122617
2015	62291	461818	11.03957	11.03578	0.07500	30398	10.32212	-0.00933	13.03919	13.04293	0.00374	11.03957	13.03919	0.01	0.122617
2016	62452	463549	11.04215	11.03957	0.07500	30702	10.33207	-0.00983	13.04293	13.04667	0.00374	11.04215	13.04293	0.01	0.122617

Table D-33
Housing Stock and Price Forecasts
Saskatchewan

[redacted]

1996-2016

[redacted]

1- GDP growth per adult = 2.65190
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 1 from Statistics Canada (weak growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation												
			[redacted]												
1996		396044								12.88928					
1997	61696	398421	11.02997			25413		0.00770	12.88928	12.89526	0.00598	11.02997	12.88928	0.026519	
1998	67393	402851	11.11829	11.02997	0.07500	26087	10.1691896	0.00353	12.89526	12.90632	0.01106	11.11829	12.89526	0.026519	0.122617
1999	72283	408530	11.18835	11.11829	0.07500	26779	10.1953631	0.00372	12.90632	12.92032	0.01400	11.18835	12.90632	0.026519	0.122617
2000	76313	415122	11.24260	11.18835	0.07500	27489	10.2215365	0.00381	12.92032	12.93633	0.01601	11.24260	12.92032	0.026519	0.122617
2001	78946	422257	11.27652	11.24260	0.07500	28218	10.24771	0.00220	12.93633	12.95337	0.01704	11.27652	12.93633	0.026519	0.122617
2002	79529	429439	11.28388	11.27652	0.07500	28966	10.2738835	-0.00193	12.95337	12.97024	0.01687	11.28388	12.95337	0.026519	0.122617
2003	80109	436666	11.29114	11.28388	0.07500	29734	10.3000569	-0.00162	12.97024	12.98692	0.01669	11.29114	12.97024	0.026519	0.122617
2004	80674	443934	11.29818	11.29114	0.07500	30523	10.3262304	-0.00138	12.98692	13.00343	0.01651	11.29818	12.98692	0.026519	0.122617
2005	81049	451196	11.30281	11.29818	0.07500	31332	10.3524039	-0.00168	13.00343	13.01966	0.01623	11.30281	13.00343	0.026519	0.122617
2006	81196	458394	11.30462	11.30281	0.07500	32163	10.3785773	-0.00226	13.01966	13.03548	0.01583	11.30462	13.01966	0.026519	0.122617
2007	81134	465473	11.30385	11.30462	0.07500	33016	10.4047508	-0.00303	13.03548	13.05081	0.01533	11.30385	13.03548	0.026519	0.122617
2008	80759	472351	11.29922	11.30385	0.07500	33892	10.4309243	-0.00432	13.05081	13.06548	0.01467	11.29922	13.05081	0.026519	0.122617
2009	80034	478931	11.29021	11.29922	0.07500	34790	10.4570977	-0.00607	13.06548	13.07931	0.01383	11.29021	13.06548	0.026519	0.122617
2010	79233	485188	11.28014	11.29021	0.07500	35713	10.4832712	-0.00744	13.07931	13.09229	0.01298	11.28014	13.07931	0.026519	0.122617
2011	78937	491257	11.27641	11.28014	0.07500	36660	10.5094447	-0.00732	13.09229	13.10472	0.01243	11.27641	13.09229	0.026519	0.122617
2012	78489	497094	11.27071	11.27641	0.07500	37632	10.5356181	-0.00880	13.10472	13.11653	0.01181	11.27071	13.10472	0.026519	0.122617
2013	78221	502748	11.26730	11.27071	0.07500	38630	10.5617916	-0.00951	13.11653	13.12784	0.01131	11.26730	13.11653	0.026519	0.122617
2014	78401	508349	11.26959	11.26730	0.07500	39655	10.5879651	-0.00938	13.12784	13.13892	0.01108	11.26959	13.12784	0.026519	0.122617
2015	79066	514036	11.27804	11.26959	0.07500	40706	10.6141385	-0.00883	13.13892	13.15005	0.01113	11.27804	13.13892	0.026519	0.122617
2016	79595	519770	11.28471	11.27804	0.07500	41786	10.640312	-0.00972	13.15005	13.16114	0.01109	11.28471	13.15005	0.026519	0.122617

Table D-34
Housing Stock and Price Forecasts
Saskatchewan

Saskatchewan

1998-2016

Medium/Medium Scenario: Medium Economic Growth and Medium Demographic Growth

1- GDP growth per adult = 2.65190
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 2 from Statistics Canada (medium growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		396044								12.88928					
1997	61696	398421	11.02997			25413		0.00770	12.88928	12.89526	0.00598	11.02997	12.88928	0.026519	
1998	67578	402899	11.12103	11.02997	0.07500	26087	10.1691896	0.00416	12.89526	12.90644	0.01118	11.12103	12.89526	0.026519	0.122617
1999	72633	408665	11.19318	11.12103	0.07500	26779	10.1953631	0.00439	12.90644	12.92065	0.01421	11.19318	12.90644	0.026519	0.122617
2000	76799	415373	11.24895	11.19318	0.07500	27489	10.2215365	0.00450	12.92065	12.93693	0.01628	11.24895	12.92065	0.026519	0.122617
2001	79669	422676	11.28564	11.24895	0.07500	28218	10.24771	0.00331	12.93693	12.95436	0.01743	11.28564	12.93693	0.026519	0.122617
2002	80422	430065	11.29504	11.28564	0.07500	28966	10.2738835	-0.00075	12.95436	12.97169	0.01733	11.29504	12.95436	0.026519	0.122617
2003	81125	437528	11.30375	11.29504	0.07500	29734	10.3000569	-0.00039	12.97169	12.98890	0.01720	11.30375	12.97169	0.026519	0.122617
2004	81777	445052	11.31175	11.30375	0.07500	30523	10.3262304	-0.00009	12.98890	13.00595	0.01705	11.31175	12.98890	0.026519	0.122617
2005	82200	452581	11.31691	11.31175	0.07500	31332	10.3524039	-0.00035	13.00595	13.02272	0.01678	11.31691	13.00595	0.026519	0.122617
2006	82508	460086	11.32065	11.31691	0.07500	32163	10.3785773	-0.00049	13.02272	13.03917	0.01645	11.32065	13.02272	0.026519	0.122617
2007	82555	467500	11.32122	11.32065	0.07500	33016	10.4047508	-0.00118	13.03917	13.05515	0.01599	11.32122	13.03917	0.026519	0.122617
2008	82247	474730	11.31748	11.32122	0.07500	33892	10.4309243	-0.00239	13.05515	13.07050	0.01535	11.31748	13.05515	0.026519	0.122617
2009	81558	481675	11.30908	11.31748	0.07500	34790	10.4570977	-0.00405	13.07050	13.08502	0.01452	11.30908	13.07050	0.026519	0.122617
2010	80773	488302	11.29940	11.30908	0.07500	35713	10.4832712	-0.00533	13.08502	13.09869	0.01366	11.29940	13.08502	0.026519	0.122617
2011	80481	494741	11.29578	11.29940	0.07500	36660	10.5094447	-0.00514	13.09869	13.11179	0.01310	11.29578	13.09869	0.026519	0.122617
2012	80029	500946	11.29014	11.29578	0.07500	37632	10.5356181	-0.00652	13.11179	13.12425	0.01246	11.29014	13.11179	0.026519	0.122617
2013	79756	506965	11.28673	11.29014	0.07500	38630	10.5617916	-0.00715	13.12425	13.13620	0.01194	11.28673	13.12425	0.026519	0.122617
2014	79923	512923	11.28882	11.28673	0.07500	39655	10.5879651	-0.00697	13.13620	13.14788	0.01168	11.28882	13.13620	0.026519	0.122617
2015	80572	518959	11.29691	11.28882	0.07500	40706	10.6141385	-0.00638	13.14788	13.15958	0.01170	11.29691	13.14788	0.026519	0.122617
2016	81090	525032	11.30331	11.29691	0.07500	41786	10.640312	-0.00718	13.15958	13.17122	0.01164	11.30331	13.15958	0.026519	0.122617

Table D-35
Housing Stock and Price Forecasts
Saskatchewan

Saskatchewan

1998-2016

Medium/Strong Scenario: Medium Economic Growth and Strong Demographic Growth

1- GDP growth per adult = 2.65190
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 3 from Statistics Canada (strong growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		396044								12.88928					
1997	61696	398421	11.02997			25413		0.00770	12.88928	12.89526	0.00598	11.02997	12.88928	0.026519	
1998	66025	402485	11.09778	11.02997	0.07500	26087	10.16919	-0.00118	12.89526	12.90541	0.01015	11.09778	12.89526	0.026519	0.122617
1999	69722	407517	11.15226	11.09778	0.07500	26779	10.19536	-0.00125	12.90541	12.91784	0.01243	11.15226	12.90541	0.026519	0.122617
2000	72755	413249	11.19485	11.15226	0.07500	27489	10.22154	-0.00145	12.91784	12.93180	0.01397	11.19485	12.91784	0.026519	0.122617
2001	74986	419450	11.22506	11.19485	0.07500	28218	10.24771	-0.00226	12.93180	12.94670	0.01490	11.22506	12.93180	0.026519	0.122617
2002	75480	425681	11.23162	11.22506	0.07500	28966	10.27388	-0.00627	12.94670	12.96145	0.01475	11.23162	12.94670	0.026519	0.122617
2003	76152	431986	11.24049	11.23162	0.07500	29734	10.30006	-0.00579	12.96145	12.97615	0.01470	11.24049	12.96145	0.026519	0.122617
2004	76944	438396	11.25083	11.24049	0.07500	30523	10.32623	-0.00536	12.97615	12.99088	0.01473	11.25083	12.97615	0.026519	0.122617
2005	77620	444879	11.25958	11.25083	0.07500	31332	10.3524	-0.00554	12.99088	13.00556	0.01468	11.25958	12.99088	0.026519	0.122617
2006	78392	451461	11.26948	11.25958	0.07500	32163	10.37858	-0.00520	13.00556	13.02024	0.01469	11.26948	13.00556	0.026519	0.122617
2007	78953	458086	11.27661	11.26948	0.07500	33016	10.40475	-0.00569	13.02024	13.03481	0.01457	11.27661	13.02024	0.026519	0.122617
2008	79146	464658	11.27905	11.27661	0.07500	33892	10.43092	-0.00680	13.03481	13.04906	0.01425	11.27905	13.03481	0.026519	0.122617
2009	78929	471069	11.27630	11.27905	0.07500	34790	10.4571	-0.00837	13.04906	13.06276	0.01370	11.27630	13.04906	0.026519	0.122617
2010	78585	477283	11.27193	11.27630	0.07500	35713	10.48327	-0.00951	13.06276	13.07587	0.01310	11.27193	13.06276	0.026519	0.122617
2011	78727	483431	11.27374	11.27193	0.07500	36660	10.50944	-0.00905	13.07587	13.08866	0.01280	11.27374	13.07587	0.026519	0.122617
2012	78698	489464	11.27337	11.27374	0.07500	37632	10.53562	-0.01019	13.08866	13.10107	0.01240	11.27337	13.08866	0.026519	0.122617
2013	78842	495432	11.27520	11.27337	0.07500	38630	10.56179	-0.01051	13.10107	13.11319	0.01212	11.27520	13.10107	0.026519	0.122617
2014	79386	501446	11.28208	11.27520	0.07500	39655	10.58797	-0.01008	13.11319	13.12525	0.01207	11.28208	13.11319	0.026519	0.122617
2015	80350	507623	11.29414	11.28208	0.07500	40706	10.61414	-0.00933	13.12525	13.13749	0.01224	11.29414	13.12525	0.026519	0.122617
2016	81179	513924	11.30442	11.29414	0.07500	41786	10.64031	-0.00983	13.13749	13.14983	0.01234	11.30442	13.13749	0.026519	0.122617

Table D-36
Housing Stock and Price Forecasts
Alberta

[redacted]

Programming: Mario Fortin and André Leclerc

Alberta

1998-2016

Weak/Weak Scenario: Weak Demographic Growth and Weak Economic Growth

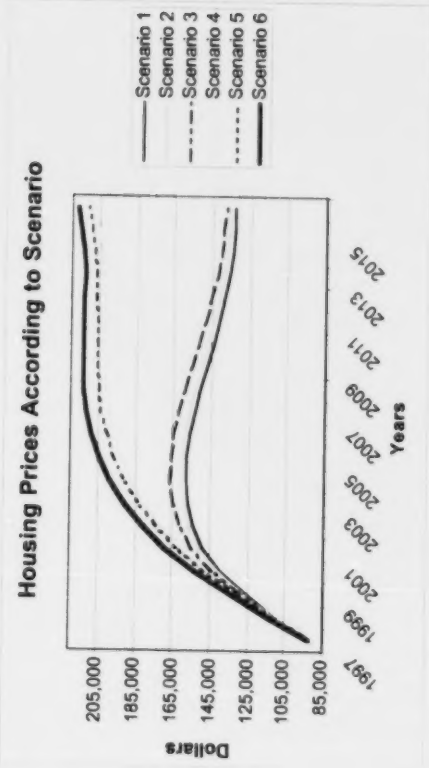
1- GDP growth per adult = 1.00000
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 1 from Statistics Canada (weak growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		1010893								13.82634					
1997	91734	1031281	11.42665			37753		0.02040	13.82634	13.84631	0.01997	11.42665	13.82634	0.01	
1998	110253	1059807	11.61053	11.42665	0.07500	38131	10.54877	0.01176	13.84631	13.87360	0.02729	11.61053	13.84631	0.01	0.445106
1999	126396	1095505	11.74718	11.61053	0.07500	38512	10.55872	0.01070	13.87360	13.90673	0.03313	11.74718	13.87360	0.01	0.445106
2000	139838	1137173	11.84824	11.74718	0.07500	38897	10.56867	0.0110[illegible]	13.90673	13.94406	0.03733	11.84824	13.90673	0.01	0.445106
2001	149540	1183149	11.91532	11.84824	0.07500	39286	10.57862	0.00945	13.94406	13.98369	0.03963	11.91532	13.94406	0.01	0.445106
2002	154648	1231390	11.94890	11.91532	0.07500	39679	10.58857	0.00521	13.98369	14.02365	0.03996	11.94890	13.98369	0.01	0.445106
2003	157350	1280823	11.96623	11.94890	0.07500	40076	10.59852	0.00505	14.02365	14.06301	0.03936	11.96623	14.02365	0.01	0.445106
2004	158319	1330604	11.97236	11.96623	0.07500	40476	10.60847	0.00535	14.06301	14.10114	0.03813	11.97236	14.06301	0.01	0.445106
2005	157835	1379937	11.96931	11.97236	0.07500	40881	10.61842	0.00520	14.10114	14.13755	0.03641	11.96931	14.10114	0.01	0.445106
2006	156120	1428059	11.95838	11.96931	0.07500	41290	10.62837	0.00442	14.13755	14.17183	0.03428	11.95838	14.13755	0.01	0.445106
2007	153740	1474451	11.94302	11.95838	0.07500	41703	10.63832	0.00393	14.17183	14.20380	0.03197	11.94302	14.17183	0.01	0.445106
2008	150784	1518609	11.92361	11.94302	0.07500	42120	10.64827	0.00277	14.20380	14.23331	0.02951	11.92361	14.20380	0.01	0.445106
2009	147508	1560160	11.90164	11.92361	0.07500	42541	10.65822	0.00140	14.23331	14.26030	0.02699	11.90164	14.23331	0.01	0.445106
2010	144257	1598949	11.87935	11.90164	0.07500	42966	10.66817	0.00028	14.26030	14.28486	0.02456	11.87935	14.26030	0.01	0.445106
2011	141362	1635078	11.85908	11.87935	0.07500	43396	10.67812	-0.00034	14.28486	14.30720	0.02234	11.85908	14.28486	0.01	0.445106
2012	138691	1668594	11.84000	11.85908	0.07500	43830	10.68808	-0.00150	14.30720	14.32749	0.02029	11.84000	14.30720	0.01	0.445106
2013	136317	1699631	11.82274	11.84000	0.07500	44268	10.69803	-0.00267	14.32749	14.34592	0.01843	11.82274	14.32749	0.01	0.445106
2014	134738	1728745	11.81109	11.82274	0.07500	44711	10.70798	-0.00240	14.34592	14.36291	0.01698	11.81109	14.34592	0.01	0.445106
2015	133770	1756392	11.80388	11.81109	0.07500	45158	10.71793	-0.00234	14.36291	14.37877	0.01587	11.80388	14.36291	0.01	0.445106
2016	133103	1782805	11.79888	11.80388	0.07500	45610	10.72788	-0.00300	14.37877	14.39370	0.01493	11.79888	14.37877	0.01	0.445106

Table D-37
Housing Stock and Price Forecasts
Alberta

Comparison of Results



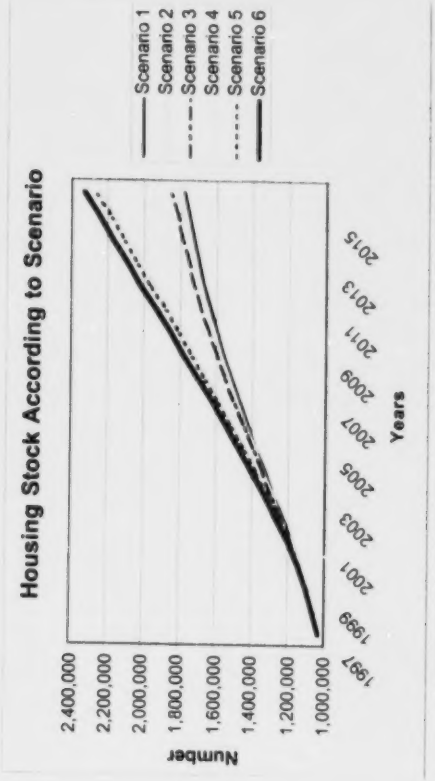


Table D-38
Housing Stock and Price Forecasts
Alberta

[redacted]

Alberta

1998-2016

Weak/Medium Scenario: Weak Economic Growth and Medium Demographic Growth

1- GDP growth per adult = 1.00000
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 2 from Statistics Canada (medium growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		1010893								13.82634					
1997	91734	1031281	11.42665			37753		0.02040	13.82634	13.84631	0.01997	11.42665	13.82634	0.01	
1998	110586	1060001	11.61355	11.42665	0.07500	38131	10.54877	0.01303	13.84631	13.87378	0.02747	11.61355	13.84631	0.01	0.445106
1999	127069	1096051	11.75249	11.61355	0.07500	38512	10.55872	0.01199	13.87378	13.90722	0.03344	11.75249	13.87378	0.01	0.445106
2000	140815	1138198	11.85520	11.75249	0.07500	38897	10.56867	0.01236	13.90722	13.94496	0.03773	11.85520	13.90722	0.01	0.445106
2001	151057	1184898	11.92541	11.85520	0.07500	39286	10.57862	0.01160	13.94496	13.98517	0.04021	11.92541	13.94496	0.01	0.445106
2002	156573	1234063	11.96128	11.92541	0.07500	39679	10.58857	0.00740	13.98517	14.02582	0.04066	11.96128	13.98517	0.01	0.445106
2003	159554	1284575	11.98014	11.96128	0.07500	40076	10.59852	0.00727	14.02582	14.06594	0.04012	11.98014	14.02582	0.01	0.445106
2004	160679	1335543	11.98716	11.98014	0.07500	40476	10.60847	0.00759	14.06594	14.10485	0.03891	11.98716	14.06594	0.01	0.445106
2005	160251	1386130	11.98450	11.98716	0.07500	40881	10.61842	0.00745	14.10485	14.14203	0.03718	11.98450	14.10485	0.01	0.445106
2006	158818	1435702	11.97552	11.98450	0.07500	41290	10.62837	0.00750	14.14203	14.17716	0.03514	11.97552	14.14203	0.01	0.445106
2007	156585	1483675	11.96136	11.97552	0.07500	41703	10.63832	0.00704	14.17716	14.21003	0.03287	11.96136	14.17716	0.01	0.445106
2008	153675	1529488	11.94260	11.96136	0.07500	42120	10.64827	0.00593	14.21003	14.24044	0.03041	11.94260	14.21003	0.01	0.445106
2009	150373	1572721	11.92088	11.94260	0.07500	42541	10.65822	0.00462	14.24044	14.26832	0.02787	11.92088	14.24044	0.01	0.445106
2010	147047	1613178	11.89851	11.92088	0.07500	42966	10.66817	0.00353	14.26832	14.29372	0.02540	11.89851	14.26832	0.01	0.445106
2011	144049	1650927	11.87791	11.89851	0.07500	43396	10.67812	0.00296	14.29372	14.31685	0.02313	11.87791	14.29372	0.01	0.445106
2012	141262	1685994	11.85837	11.87791	0.07500	43830	10.68808	0.00185	14.31685	14.33787	0.02102	11.85837	14.31685	0.01	0.445106
2013	138770	1718499	11.84057	11.85837	0.07500	44268	10.69803	0.00074	14.33787	14.35696	0.01910	11.84057	14.33787	0.01	0.445106
2014	137069	1748981	11.82824	11.84057	0.07500	44711	10.70798	0.00102	14.35696	14.37454	0.01758	11.82824	14.35696	0.01	0.445106
2015	135974	1777885	11.82022	11.82824	0.07500	45158	10.71793	0.00106	14.37454	14.39093	0.01639	11.82022	14.37454	0.01	0.445106
2016	135190	1805445	11.81444	11.82022	0.07500	45610	10.72788	0.00043	14.39093	14.40632	0.01538	11.81444	14.39093	0.01	0.445106

Table D-39
Housing Stock and Price Forecasts
Alberta

Alberta

1998-2016

Weak/Strong Scenario: Weak Economic Growth and Strong Demographic Growth

1- GDP growth per adult = 1.00000
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 3 from Statistics Canada (strong growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		1010893								13.82634					
1997	91734	1031281	11.42665			37753		0.02040	13.82634	13.84631	0.01997	11.42665	13.82634	0.01	
1998	111794	1060700	11.62441	11.42665	0.07500	38131	10.54877	0.01759	13.84631	13.87444	0.02813	11.62441	13.84631	0.01	0.445106
1999	129544	1098029	11.77178	11.62441	0.07500	38512	10.55872	0.01669	13.87444	13.90903	0.03459	11.77178	13.87444	0.01	0.445106
2000	144432	1141925	11.88056	11.77178	0.07500	38897	10.56867	0.01708	13.90903	13.94823	0.03920	11.88056	13.90903	0.01	0.445106
2001	155818	1190862	11.95644	11.88056	0.07500	39286	10.57862	0.01700	13.94823	13.99019	0.04196	11.95644	13.94823	0.01	0.445106
2002	162067	1242622	11.99577	11.95644	0.07500	39679	10.58857	0.01273	13.99019	14.03273	0.04255	11.99577	13.99019	0.01	0.445106
2003	165435	1295969	12.01634	11.99577	0.07500	40076	10.59852	0.01254	14.03273	14.07477	0.04203	12.01634	14.03273	0.01	0.445106
2004	166741	1349941	12.02419	12.01634	0.07500	40476	10.60847	0.01300	14.07477	14.11557	0.04080	12.02419	14.07477	0.01	0.445106
2005	166315	1403631	12.02164	12.02419	0.07500	40881	10.61842	0.01298	14.11557	14.15457	0.03900	12.02164	14.11557	0.01	0.445106
2006	164930	1456430	12.01328	12.02164	0.07500	41290	10.62837	0.01358	14.15457	14.19150	0.03693	12.01328	14.15457	0.01	0.445106
2007	162579	1507662	11.99892	12.01328	0.07500	41703	10.63832	0.01317	14.19150	14.22607	0.03457	11.99892	14.19150	0.01	0.445106
2008	159404	1556669	11.97920	11.99892	0.07500	42120	10.64827	0.01202	14.22607	14.25806	0.03199	11.97920	14.22607	0.01	0.445106
2009	155744	1602948	11.95597	11.97920	0.07500	42541	10.65822	0.01067	14.25806	14.28736	0.02930	11.95597	14.25806	0.01	0.445106
2010	152037	1646258	11.93188	11.95597	0.07500	42966	10.66817	0.00961	14.28736	14.31402	0.02666	11.93188	14.28736	0.01	0.445106
2011	148656	1686630	11.90939	11.93188	0.07500	43396	10.67812	0.00903	14.31402	14.33824	0.02423	11.90939	14.31402	0.01	0.445106
2012	145497	1724065	11.88791	11.90939	0.07500	43830	10.68808	0.00791	14.33824	14.36020	0.02195	11.88791	14.33824	0.01	0.445106
2013	142654	1758674	11.86818	11.88791	0.07500	44268	10.69803	0.00679	14.36020	14.38007	0.01988	11.86818	14.36020	0.01	0.445106
2014	140640	1791004	11.85396	11.86818	0.07500	44711	10.70798	0.00704	14.38007	14.39829	0.01822	11.85396	14.38007	0.01	0.445106
2015	139325	1821558	11.84457	11.85396	0.07500	45158	10.71793	0.00723	14.39829	14.41520	0.01692	11.84457	14.39829	0.01	0.445106
2016	138346	1850584	11.83751	11.84457	0.07500	45610	10.72788	0.00661	14.41520	14.43101	0.01581	11.83751	14.41520	0.01	0.445106

Table D-40
Housing Stock and Price Forecasts
Alberta

[redacted]

Alberta

1996-2016

Medium/Weak Scenario: Medium Economic Growth and Weak Demographic Growth

1- GDP growth per adult = 2.21230
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 1 from Statistics Canada (weak growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25,54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		1010893								13.82634					
1997	91734	1031281	11.42665			37753		0.02040	13.82634	13.84631	0.01997	11.42665	13.82634	0.022123	
1998	111443	1060646	11.62126	11.42665	0.07500	38588	10.56070	0.01176	13.84631	13.87439	0.02808	11.62126	13.84631	0.022123	0.445106
1999	130170	1098519	11.77660	11.62126	0.07500	39442	10.58258	0.01070	13.87439	13.90947	0.03508	11.77660	13.87439	0.022123	0.445106
2000	147557	1144163	11.90197	11.77660	0.07500	40314	10.60447	0.01107	13.90947	13.95018	0.04071	11.90197	13.90947	0.022123	0.445106
2001	162284	1196340	11.99710	11.90197	0.07500	41206	10.62635	0.00945	13.95018	13.99478	0.04459	11.99710	13.95018	0.022123	0.445106
2002	172983	1253365	12.06095	11.99710	0.07500	42118	10.64823	0.00521	13.99478	14.04134	0.04657	12.06095	13.99478	0.022123	0.445106
2003	181594	1314461	12.10953	12.06095	0.07500	43050	10.67011	0.00505	14.04134	14.08894	0.04759	12.10953	14.04134	0.022123	0.445106
2004	188525	1379006	12.14699	12.10953	0.07500	44002	10.69199	0.00535	14.08894	14.13687	0.04794	12.14699	14.08894	0.022123	0.445106
2005	193809	1446351	12.17463	12.14699	0.07500	44976	10.71387	0.00520	14.13687	14.18455	0.04768	12.17463	14.13687	0.022123	0.445106
2006	197459	1515795	12.19329	12.17463	0.07500	45971	10.73576	0.00442	14.18455	14.23145	0.04690	12.19329	14.18455	0.022123	0.445106
2007	200000	1586817	12.20607	12.19329	0.07500	46988	10.75764	0.00393	14.23145	14.27724	0.04579	12.20607	14.23145	0.022123	0.445106
2008	201427	1658834	12.21318	12.20607	0.07500	48027	10.77952	0.00277	14.27724	14.32163	0.04438	12.21318	14.27724	0.022123	0.445106
2009	202002	1731335	12.21603	12.21318	0.07500	49090	10.80140	0.00140	14.32163	14.36440	0.04278	12.21603	14.32163	0.022123	0.445106
2010	202167	1803996	12.21685	12.21603	0.07500	50176	10.82328	0.00028	14.36440	14.40552	0.04111	12.21685	14.36440	0.022123	0.445106
2011	202407	1876747	12.21804	12.21685	0.07500	51286	10.84517	-0.00034	14.40552	14.44505	0.03954	12.21804	14.40552	0.022123	0.445106
2012	202576	1949437	12.21887	12.21804	0.07500	52420	10.86705	-0.00150	14.44505	14.48305	0.03800	12.21887	14.44505	0.022123	0.445106
2013	202825	2022011	12.22010	12.21887	0.07500	53580	10.88893	-0.00267	14.48305	14.51960	0.03655	12.22010	14.48305	0.022123	0.445106
2014	203958	2094923	12.22567	12.22010	0.07500	54765	10.91081	-0.00240	14.51960	14.55503	0.03542	12.22567	14.51960	0.022123	0.445106
2015	205781	2168553	12.23457	12.22567	0.07500	55977	10.93269	-0.00234	14.55503	14.58957	0.03454	12.23457	14.55503	0.022123	0.445106
2016	207877	2243044	12.24470	12.23457	0.07500	57215	10.95458	-0.00300	14.58957	14.62334	0.03377	12.24470	14.58957	0.022123	0.445106

Table D-41
Housing Stock and Price Forecasts
Alberta

[redacted]

1998-2016

[redacted]

1- GDP growth per adult = 2.21230
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 2 from Statistics Canada (medium growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate for 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation												
1996		1010893								13.82634					
1997	91734	1031281	11.42665			37753		0.02040	13.82634	13.84631	0.01997	11.42665	13.82634	0.022123	
1998	111780	1060841	11.62429	11.42665	0.07500	38588	10.56070	0.01303	13.84631	13.87457	0.02826	11.62429	13.84631	0.022123	0.445106
1999	130863	1099067	11.78191	11.62429	0.07500	39442	10.58258	0.01199	13.87457	13.90997	0.03540	11.78191	13.87457	0.022123	0.445106
2000	148588	1145194	11.90893	11.78191	0.07500	40314	10.60447	0.01236	13.90997	13.95108	0.04111	11.90893	13.90997	0.022123	0.445106
2001	163930	1198108	12.00720	11.90893	0.07500	41206	10.62635	0.01160	13.95108	13.99625	0.04517	12.00720	13.95108	0.022123	0.445106
2002	175136	1256085	12.07332	12.00720	0.07500	42118	10.64823	0.00740	13.99625	14.04351	0.04726	12.07332	13.99625	0.022123	0.445106
2003	184137	1318311	12.12343	12.07332	0.07500	43050	10.67011	0.00727	14.04351	14.09186	0.04835	12.12343	14.04351	0.022123	0.445106
2004	191335	1384124	12.16178	12.12343	0.07500	44002	10.69199	0.00759	14.09186	14.14058	0.04872	12.16178	14.09186	0.022123	0.445106
2005	196775	1452842	12.18982	12.16178	0.07500	44976	10.71387	0.00745	14.14058	14.18903	0.04845	12.18982	14.14058	0.022123	0.445106
2006	200872	1523908	12.21042	12.18982	0.07500	45971	10.73576	0.00750	14.18903	14.23679	0.04776	12.21042	14.18903	0.022123	0.445106
2007	203701	1596744	12.22441	12.21042	0.07500	46988	10.75764	0.00704	14.23679	14.28348	0.04669	12.22441	14.23679	0.022123	0.445106
2008	205289	1670717	12.23217	12.22441	0.07500	48027	10.77952	0.00593	14.28348	14.32876	0.04529	12.23217	14.28348	0.022123	0.445106
2009	205926	1745274	12.23527	12.23217	0.07500	49090	10.80140	0.00462	14.32876	14.37242	0.04366	12.23527	14.32876	0.022123	0.445106
2010	206077	1820050	12.23601	12.23527	0.07500	50176	10.82328	0.00353	14.37242	14.41437	0.04195	12.23601	14.37242	0.022123	0.445106
2011	206254	1894939	12.23686	12.23601	0.07500	51286	10.84517	0.00296	14.41437	14.45470	0.04032	12.23686	14.41437	0.022123	0.445106
2012	206332	1969766	12.23724	12.23686	0.07500	52420	10.86705	0.00185	14.45470	14.49343	0.03873	12.23724	14.45470	0.022123	0.445106
2013	206475	2044458	12.23793	12.23724	0.07500	53580	10.88893	0.00074	14.49343	14.53064	0.03722	12.23793	14.49343	0.022123	0.445106
2014	207486	2119445	12.24282	12.23793	0.07500	54765	10.91081	0.00102	14.53064	14.56666	0.03602	12.24282	14.53064	0.022123	0.445106
2015	209171	2195089	12.25091	12.24282	0.07500	55977	10.93269	0.00106	14.56666	14.60173	0.03507	12.25091	14.56666	0.022123	0.445106
2016	211137	2271527	12.26026	12.25091	0.07500	57215	10.95458	0.00043	14.60173	14.63596	0.03423	12.26026	14.60173	0.022123	0.445106

Table D-42
Housing Stock and Price Forecasts
Alberta

[redacted]

Alberta

1996-2016

Medium/Strong Scenario: Medium Economic Growth and Strong Demographic Growth

1- GDP growth per adult = 2.21230
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 3 from Statistics Canada (strong growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		1010893								13.82634					
1997	91734	1031281	11.42665			37753		0.02040	13.82634	13.84631	0.01997	11.42665	13.82634	0.022123	
1998	113001	1061540	11.63515	11.42665	0.07500	38588	10.56070	0.01759	13.84631	13.87523	0.02892	11.63515	13.84631	0.022123	0.445106
1999	133412	1101050	11.80120	11.63515	0.07500	39442	10.58258	0.01669	13.87523	13.91177	0.03654	11.80120	13.87523	0.022123	0.445106
2000	152405	1148944	11.93430	11.80120	0.07500	40314	10.60447	0.01708	13.91177	13.95435	0.04258	11.93430	13.91177	0.022123	0.445106
2001	169097	1204139	12.03823	11.93430	0.07500	41206	10.62635	0.01700	13.95435	14.00128	0.04692	12.03823	13.95435	0.022123	0.445106
2002	181282	1264797	12.10781	12.03823	0.07500	42118	10.64823	0.01273	14.00128	14.05042	0.04915	12.10781	14.00128	0.022123	0.445106
2003	190925	1330004	12.15963	12.10781	0.07500	43050	10.67011	0.01254	14.05042	14.10069	0.05027	12.15963	14.05042	0.022123	0.445106
2004	198554	1399046	12.19881	12.15963	0.07500	44002	10.69199	0.01300	14.10069	14.15130	0.05061	12.19881	14.10069	0.022123	0.445106
2005	204221	1471184	12.22696	12.19881	0.07500	44976	10.71387	0.01298	14.15130	14.20158	0.05028	12.22696	14.15130	0.022123	0.445106
2006	208601	1545909	12.24818	12.22696	0.07500	45971	10.73576	0.01358	14.20158	14.25112	0.04954	12.24818	14.20158	0.022123	0.445106
2007	211498	1622559	12.26197	12.24818	0.07500	46988	10.75764	0.01317	14.25112	14.29951	0.04839	12.26197	14.25112	0.022123	0.445106
2008	212942	1700408	12.26877	12.26197	0.07500	48027	10.77952	0.01202	14.29951	14.34638	0.04686	12.26877	14.29951	0.022123	0.445106
2009	213280	1778818	12.27036	12.26877	0.07500	49090	10.80140	0.01067	14.34638	14.39146	0.04508	12.27036	14.34638	0.022123	0.445106
2010	213071	1857373	12.26938	12.27036	0.07500	50176	10.82328	0.00961	14.39146	14.43467	0.04321	12.26938	14.39146	0.022123	0.445106
2011	212852	1935918	12.26835	12.26938	0.07500	51286	10.84517	0.00903	14.43467	14.47609	0.04142	12.26835	14.43467	0.022123	0.445106
2012	212518	2014245	12.26678	12.26835	0.07500	52420	10.86705	0.00791	14.47609	14.51575	0.03966	12.26678	14.47609	0.022123	0.445106
2013	212254	2092253	12.26554	12.26678	0.07500	53580	10.88893	0.00679	14.51575	14.55375	0.03800	12.26554	14.51575	0.022123	0.445106
2014	212892	2170369	12.26854	12.26554	0.07500	54765	10.91081	0.00704	14.55375	14.59041	0.03666	12.26854	14.55375	0.022123	0.445106
2015	214326	2249011	12.27525	12.26854	0.07500	55977	10.93269	0.00723	14.59041	14.62600	0.03559	12.27525	14.59041	0.022123	0.445106
2016	216065	2328320	12.28334	12.27525	0.07500	57215	10.95458	0.00661	14.62600	14.66066	0.03466	12.28334	14.62600	0.022123	0.445106

Table D-43
Housing Stock and Price Forecasts
British Columbia

British Columbia

1998-2016

Weak/Weak Scenario: Weak Economic Growth and Weak Demographic Growth

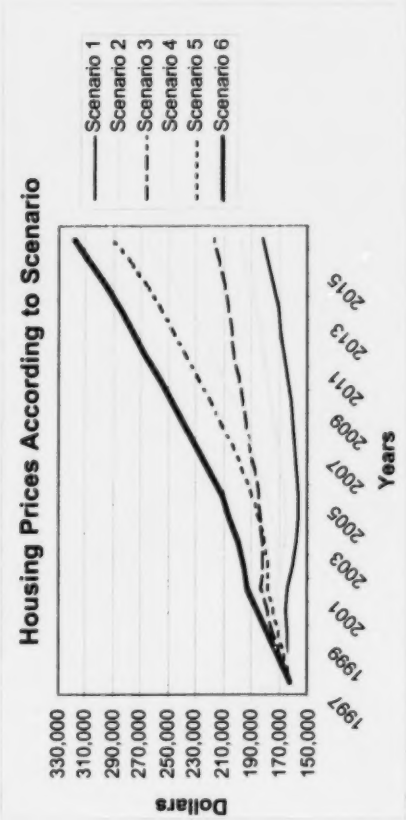
1- GDP growth per adult = 1.00000
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 1 from Statistics Canada (weak growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	N(t-1)
1996		1451388								14.18803					
1997	162003	1498687	11.99537			22447		0.02326	14.18803	14.22010	0.03207	11.99537	14.18803	0.01	
1998	163788	1531853	12.00633	11.99537	0.07500	22671	10.02886	0.01885	14.22010	14.24199	0.02169	12.00633	14.22010	0.01	0.02134
1999	164507	1563806	12.01071	12.00633	0.07500	22898	10.03881	0.01698	14.24199	14.26263	0.02064	12.01071	14.24199	0.01	0.02134
2000	165543	1594956	12.01699	12.01071	0.07500	23127	10.04876	0.01634	14.26263	14.28236	0.01972	12.01699	14.26263	0.01	0.02134
2001	164612	1624591	12.01135	12.01699	0.07500	23358	10.05871	0.01326	14.28236	14.30077	0.01841	12.01135	14.28236	0.01	0.02134
2002	160188	1651383	11.98411	12.01135	0.07500	23592	10.06866	0.00793	14.30077	14.31712	0.01636	11.98411	14.30077	0.01	0.02134
2003	157604	1676057	11.96784	11.98411	0.07500	23828	10.07861	0.00758	14.31712	14.33195	0.01483	11.96784	14.31712	0.01	0.02134
2004	156892	1699402	11.96331	11.96784	0.07500	24066	10.08856	0.00774	14.33195	14.34579	0.01383	11.96331	14.33195	0.01	0.02134
2005	156866	1721732	11.96315	11.96331	0.07500	24307	10.09851	0.00698	14.34579	14.35884	0.01305	11.96315	14.34579	0.01	0.02134
2006	157160	1743206	11.96502	11.96315	0.07500	24550	10.10847	0.00593	14.35884	14.37124	0.01240	11.96502	14.35884	0.01	0.02134
2007	158524	1764302	11.97366	11.96502	0.07500	24795	10.11842	0.00578	14.37124	14.38327	0.01203	11.97366	14.37124	0.01	0.02134
2008	160105	1785120	11.98358	11.97366	0.07500	25043	10.12837	0.00490	14.38327	14.39500	0.01173	11.98358	14.38327	0.01	0.02134
2009	161948	1805780	11.99503	11.98358	0.07500	25294	10.13832	0.00409	14.39500	14.40650	0.01151	11.99503	14.39500	0.01	0.02134
2010	164175	1826444	12.00869	11.99503	0.07500	25547	10.14827	0.00346	14.40650	14.41788	0.01138	12.00869	14.40650	0.01	0.02134
2011	166929	1847328	12.02532	12.00869	0.07500	25802	10.15822	0.00304	14.41788	14.42925	0.01137	12.02532	14.41788	0.01	0.02134
2012	169279	1868248	12.03930	12.02532	0.07500	26060	10.16817	0.00172	14.42925	14.44051	0.01126	12.03930	14.42925	0.01	0.02134
2013	171301	1889061	12.05118	12.03930	0.07500	26321	10.17812	0.00039	14.44051	14.45159	0.01108	12.05118	14.44051	0.01	0.02134
2014	174621	1910305	12.07037	12.05118	0.07500	26584	10.18807	0.00068	14.45159	14.46277	0.01118	12.07037	14.45159	0.01	0.02134
2015	178655	1932243	12.09321	12.07037	0.07500	26850	10.19802	0.00059	14.46277	14.47419	0.01142	12.09321	14.46277	0.01	0.02134
2016	182858	1954898	12.11647	12.09321	0.07500	27118	10.20797	0.00006	14.47419	14.48585	0.01166	12.11647	14.47419	0.01	0.02134

Table D-44
Housing Stock and Price Forecasts
British Columbia

Comparison of Results



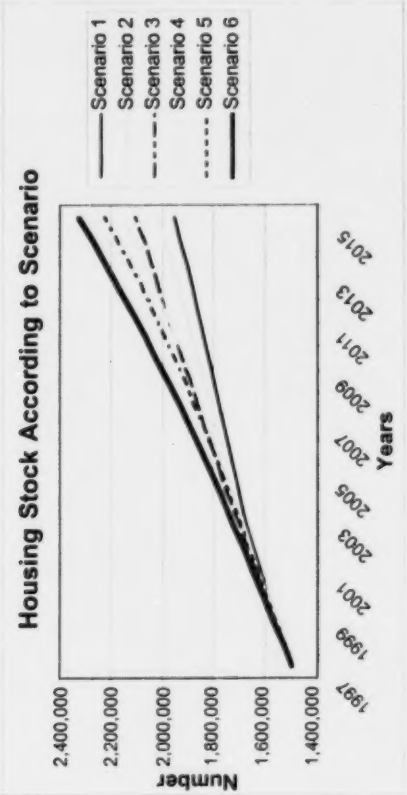


Table D-45
Housing Stock and Price Forecasts
British Columbia

[redacted]

1998-2016

[redacted]

1- GDP growth per adult = 1.00000
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 2 from Statistics Canada (medium growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation												
[redacted]															
1996		1451388								14.18803					
1997	162003	1498687	11.99537			22447		0.02326	14.18803	14.22010	0.03207	11.99537	14.18803	0.01	
1998	165360	1532404	12.01588	11.99537	0.07500	22671	10.02886	0.02057	14.22010	14.24235	0.02225	12.01588	14.22010	0.01	0.02134
1999	167322	1565336	12.02768	12.01588	0.07500	22898	10.03881	0.01869	14.24235	14.26361	0.02126	12.02768	14.24235	0.01	0.02134
2000	169333	1597791	12.03962	12.02768	0.07500	23127	10.04876	0.01804	14.26361	14.28413	0.02052	12.03962	14.26361	0.01	0.02134
2001	170206	1629366	12.04476	12.03962	0.07500	23358	10.05871	0.01612	14.28413	14.30370	0.01957	12.04476	14.28413	0.01	0.02134
2002	167041	1658578	12.02600	12.04476	0.07500	23592	10.06866	0.01082	14.30370	14.32147	0.01777	12.02600	14.30370	0.01	0.02134
2003	165410	1686017	12.01618	12.02600	0.07500	23828	10.07861	0.01048	14.32147	14.33788	0.01641	12.01618	14.32147	0.01	0.02134
2004	165446	1712354	12.01640	12.01618	0.07500	24066	10.08856	0.01063	14.33788	14.35338	0.01550	12.01640	14.33788	0.01	0.02134
2005	165986	1737811	12.01966	12.01640	0.07500	24307	10.09851	0.00986	14.35338	14.36814	0.01476	12.01966	14.35338	0.01	0.02134
2006	167706	1762879	12.02997	12.01966	0.07500	24550	10.10847	0.00991	14.36814	14.38246	0.01432	12.02997	14.36814	0.01	0.02134
2007	170224	1787881	12.04487	12.02997	0.07500	24795	10.11842	0.00976	14.38246	14.39654	0.01408	12.04487	14.38246	0.01	0.02134
2008	172711	1812802	12.05937	12.04487	0.07500	25043	10.12837	0.00887	14.39654	14.41038	0.01384	12.05937	14.39654	0.01	0.02134
2009	175265	1837666	12.07405	12.05937	0.07500	25294	10.13832	0.00807	14.41038	14.42401	0.01362	12.07405	14.41038	0.01	0.02134
2010	178055	1862561	12.08985	12.07405	0.07500	25547	10.14827	0.00744	14.42401	14.43746	0.01346	12.08985	14.42401	0.01	0.02134
2011	181263	1887645	12.10771	12.08985	0.07500	25802	10.15822	0.00701	14.43746	14.45084	0.01338	12.10771	14.43746	0.01	0.02134
2012	183951	1912697	12.12242	12.10771	0.07500	26060	10.16817	0.00572	14.45084	14.46402	0.01318	12.12242	14.45084	0.01	0.02134
2013	186217	1937548	12.13467	12.12242	0.07500	26321	10.17812	0.00442	14.46402	14.47693	0.01291	12.13467	14.46402	0.01	0.02134
2014	189770	1962704	12.15357	12.13467	0.07500	26584	10.18807	0.00467	14.47693	14.48983	0.01290	12.15357	14.47693	0.01	0.02134
2015	194008	1988408	12.17565	12.15357	0.07500	26850	10.19802	0.00454	14.48983	14.50285	0.01301	12.17565	14.48983	0.01	0.02134
2016	198376	2014674	12.19792	12.17565	0.07500	27118	10.20797	0.00399	14.50285	14.51597	0.01312	12.19792	14.50285	0.01	0.02134

Table D-46
Housing Stock and Price Forecasts
British Columbia

British Columbia

1998-2016

Weak/Strong Scenario: Weak Economic Growth and Strong Demographic Growth

1- GDP growth per adult = 1.00000
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 3 from Statistics Canada (strong growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		1451388								14.18803					
1997	162003	1498687	11.99537			22447		0.02326	14.18803	14.22010	0.03207	11.99537	14.18803	0.01	
1998	168901	1533627	12.03707	11.99537	0.07500	22671	10.02886	0.02439	14.22010	14.24315	0.02305	12.03707	14.22010	0.01	0.02134
1999	174059	1568845	12.06715	12.03707	0.07500	22898	10.03881	0.02281	14.24315	14.26585	0.02270	12.06715	14.24315	0.01	0.02134
2000	179073	1604547	12.09555	12.06715	0.07500	23127	10.04876	0.02257	14.26585	14.28835	0.02250	12.09555	14.26585	0.01	0.02134
2001	183435	1640486	12.11962	12.09555	0.07500	23358	10.05871	0.02179	14.28835	14.31050	0.02215	12.11962	14.28835	0.01	0.02134
2002	182601	1674870	12.11506	12.11962	0.07500	23592	10.06866	0.01644	14.31050	14.33125	0.02074	12.11506	14.31050	0.01	0.02134
2003	182677	1708021	12.11548	12.11506	0.07500	23828	10.07861	0.01603	14.33125	14.35085	0.01960	12.11548	14.33125	0.01	0.02134
2004	183852	1740344	12.12189	12.11548	0.07500	24066	10.08856	0.01594	14.35085	14.36959	0.01875	12.12189	14.35085	0.01	0.02134
2005	185000	1771839	12.12811	12.12189	0.07500	24307	10.09851	0.01494	14.36959	14.38753	0.01793	12.12811	14.36959	0.01	0.02134
2006	187791	1803114	12.14309	12.12811	0.07500	24550	10.10847	0.01552	14.38753	14.40503	0.01750	12.14309	14.38753	0.01	0.02134
2007	191091	1834352	12.16051	12.14309	0.07500	24795	10.11842	0.01527	14.40503	14.42220	0.01718	12.16051	14.40503	0.01	0.02134
2008	194048	1865420	12.17586	12.16051	0.07500	25043	10.12837	0.01429	14.42220	14.43900	0.01679	12.17586	14.42220	0.01	0.02134
2009	196822	1896249	12.19005	12.17586	0.07500	25294	10.13832	0.01338	14.43900	14.45539	0.01639	12.19005	14.43900	0.01	0.02134
2010	199616	1926847	12.20415	12.19005	0.07500	25547	10.14827	0.01261	14.45539	14.47140	0.01601	12.20415	14.45539	0.01	0.02134
2011	202654	1957302	12.21926	12.20415	0.07500	25802	10.15822	0.01201	14.47140	14.48708	0.01568	12.21926	14.47140	0.01	0.02134
2012	204954	1987342	12.23054	12.21926	0.07500	26060	10.16817	0.01058	14.48708	14.50231	0.01523	12.23054	14.48708	0.01	0.02134
2013	206738	2016786	12.23921	12.23054	0.07500	26321	10.17812	0.00920	14.50231	14.51702	0.01471	12.23921	14.50231	0.01	0.02134
2014	209770	2046107	12.25377	12.23921	0.07500	26584	10.18807	0.00924	14.51702	14.53145	0.01443	12.25377	14.51702	0.01	0.02134
2015	213427	2075533	12.27105	12.25377	0.07500	26850	10.19802	0.00892	14.53145	14.54573	0.01428	12.27105	14.53145	0.01	0.02134
2016	217139	2105070	12.28829	12.27105	0.07500	27118	10.20797	0.00819	14.54573	14.55986	0.01413	12.28829	14.54573	0.01	0.02134

Table D-47
Housing Stock and Price Forecasts
British Columbia

British Columbia

1998-2016

Medium/Weak Scenario: Medium Economic Growth and Weak Demographic Growth

1- GDP growth per adult = 1.58730
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 1 from Statistics Canada (weak growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		1451388								14.18803					
1997	162003	1498687	11.99537			22447		0.02326	14.18803	14.22010	0.03207	11.99537	14.18803	0.015873	
1998	164780	1532305	12.01237	11.99537	0.07500	22803	10.03466	0.01885	14.22010	14.24228	0.02218	12.01237	14.22010	0.015873	0.02134
1999	167294	1565338	12.02751	12.01237	0.07500	23165	10.05041	0.01698	14.24228	14.26361	0.02133	12.02751	14.24228	0.015873	0.02134
2000	170791	1598418	12.04820	12.02751	0.07500	23533	10.06616	0.01634	14.26361	14.28452	0.02091	12.04820	14.26361	0.015873	0.02134
2001	172778	1631002	12.05977	12.04820	0.07500	23906	10.08191	0.01326	14.28452	14.30471	0.02018	12.05977	14.28452	0.015873	0.02134
2002	171413	1661880	12.05183	12.05977	0.07500	24286	10.09765	0.00793	14.30471	14.32346	0.01875	12.05183	14.30471	0.015873	0.02134
2003	172199	1691862	12.05640	12.05183	0.07500	24671	10.11340	0.00758	14.32346	14.34134	0.01788	12.05640	14.32346	0.015873	0.02134
2004	175221	1721793	12.07380	12.05640	0.07500	25063	10.12915	0.00774	14.34134	14.35888	0.01754	12.07380	14.34134	0.015873	0.02134
2005	179208	1752023	12.09630	12.07380	0.07500	25461	10.14490	0.00698	14.35888	14.37628	0.01740	12.09630	14.35888	0.015873	0.02134
2006	183741	1782727	12.12128	12.09630	0.07500	25865	10.16065	0.00593	14.37628	14.39365	0.01737	12.12128	14.37628	0.015873	0.02134
2007	189714	1814394	12.15327	12.12128	0.07500	26276	10.17640	0.00578	14.39365	14.41126	0.01761	12.15327	14.39365	0.015873	0.02134
2008	196146	1847126	12.18662	12.15327	0.07500	26693	10.19214	0.00490	14.41126	14.42914	0.01788	12.18662	14.41126	0.015873	0.02134
2009	203090	1881036	12.22143	12.18662	0.07500	27116	10.20789	0.00409	14.42914	14.44733	0.01819	12.22143	14.42914	0.015873	0.02134
2010	210723	1916281	12.25830	12.22143	0.07500	27547	10.22364	0.00346	14.44733	14.46590	0.01856	12.25830	14.44733	0.015873	0.02134
2011	219242	1953077	12.29793	12.25830	0.07500	27984	10.23939	0.00304	14.46590	14.48492	0.01902	12.29793	14.46590	0.015873	0.02134
2012	227441	1991216	12.33465	12.29793	0.07500	28428	10.25514	0.00172	14.48492	14.50426	0.01934	12.33465	14.48492	0.015873	0.02134
2013	235382	2030531	12.36896	12.33465	0.07500	28879	10.27089	0.00039	14.50426	14.52381	0.01955	12.36896	14.50426	0.015873	0.02134
2014	245315	2071584	12.41030	12.36896	0.07500	29338	10.28663	0.00068	14.52381	14.54382	0.02002	12.41030	14.52381	0.015873	0.02134
2015	256521	2114659	12.45496	12.41030	0.07500	29804	10.30238	0.00059	14.54382	14.56440	0.02058	12.45496	14.54382	0.015873	0.02134
2016	268267	2159788	12.49974	12.45496	0.07500	30277	10.31813	0.00006	14.56440	14.58552	0.02112	12.49974	14.56440	0.015873	0.02134

Table D-48
Housing Stock and Price Forecasts
British Columbia

British Columbia

1998-2016

Medium/Medium Scenario: Medium Economic Growth and Medium Demographic Growth

1- GDP growth per adult = 1.58730
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 2 from Statistics Canada (medium growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		1451388								14.18803					
1997	162003	1498687	11.99537			22447		0.02326	14.18803	14.22010	0.03207	11.99537	14.18803	0.015873	
1998	166361	1532856	12.02192	11.99537	0.07500	22803	10.03466	0.02057	14.22010	14.24264	0.02254	12.02192	14.22010	0.015873	0.02134
1999	170157	1566870	12.04447	12.02192	0.07500	23165	10.05041	0.01869	14.24264	14.26459	0.02195	12.04447	14.24264	0.015873	0.02134
2000	174701	1601259	12.07083	12.04447	0.07500	23533	10.06616	0.01804	14.26459	14.28630	0.02171	12.07083	14.26459	0.015873	0.02134
2001	178650	1635796	12.09318	12.07083	0.07500	23906	10.08191	0.01612	14.28630	14.30764	0.02134	12.09318	14.28630	0.015873	0.02134
2002	178746	1669121	12.09372	12.09318	0.07500	24286	10.09765	0.01082	14.30764	14.32781	0.02017	12.09372	14.30764	0.015873	0.02134
2003	180728	1701916	12.10475	12.09372	0.07500	24671	10.11340	0.01048	14.32781	14.34727	0.01946	12.10475	14.32781	0.015873	0.02134
2004	184775	1734916	12.12689	12.10475	0.07500	25063	10.12915	0.01063	14.34727	14.36647	0.01920	12.12689	14.34727	0.015873	0.02134
2005	189626	1768385	12.15281	12.12689	0.07500	25461	10.14490	0.00986	14.36647	14.38558	0.01911	12.15281	14.36647	0.015873	0.02134
2006	196072	1802845	12.18623	12.15281	0.07500	25865	10.16065	0.00991	14.38558	14.40488	0.01930	12.18623	14.38558	0.015873	0.02134
2007	203717	1838643	12.22449	12.18623	0.07500	26276	10.17640	0.00976	14.40488	14.42454	0.01966	12.22449	14.40488	0.015873	0.02134
2008	211590	1875770	12.26241	12.22449	0.07500	26693	10.19214	0.00887	14.42454	14.44453	0.01999	12.26241	14.42454	0.015873	0.02134
2009	219795	1914251	12.30045	12.26241	0.07500	27116	10.20789	0.00807	14.44453	14.46484	0.02031	12.30045	14.44453	0.015873	0.02134
2010	228538	1954175	12.33946	12.30045	0.07500	27547	10.22364	0.00744	14.46484	14.48548	0.02064	12.33946	14.46484	0.015873	0.02134
2011	238068	1995701	12.38031	12.33946	0.07500	27984	10.23939	0.00701	14.48548	14.50651	0.02103	12.38031	14.48548	0.015873	0.02134
2012	247153	2038591	12.41776	12.38031	0.07500	28428	10.25514	0.00572	14.50651	14.52777	0.02126	12.41776	14.50651	0.015873	0.02134
2013	255878	2082649	12.45246	12.41776	0.07500	28879	10.27089	0.00442	14.52777	14.54915	0.02138	12.45246	14.52777	0.015873	0.02134
2014	266597	2128407	12.49349	12.45246	0.07500	29338	10.28663	0.00467	14.54915	14.57088	0.02173	12.49349	14.54915	0.015873	0.02134
2015	278566	2176127	12.53741	12.49349	0.07500	29804	10.30238	0.00454	14.57088	14.59306	0.02217	12.53741	14.57088	0.015873	0.02134
2016	291032	2225829	12.58119	12.53741	0.07500	30277	10.31813	0.00399	14.59306	14.61564	0.02258	12.58119	14.59306	0.015873	0.02134

Table D-49
Housing Stock and Price Forecasts
British Columbia

[redacted]

Programming: Mario Fortin and André Leclerc

British Columbia

1996-2016

Medium Growth Scenario: Medium Economic Growth and Strong Demographic Growth

1- GDP growth per adult = 1.58730
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 3 from Statistics Canada (strong growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Year	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25,54)	Ln N(25,54)	Ln St	Var Ln St	Ln St-1	Ln St-2	Variant	Const
1996		1451388								14.18803					
1997	162003	1498687	11.99537			22447		0.02326	14.18803	14.22010	0.03207	11.99537	14.18803	0.015873	
1998	169924	1534079	12.04311	11.99537	0.07500	22803	10.03466	0.02439	14.22010	14.24344	0.02334	12.04311	14.22010	0.015873	0.02134
1999	177008	1570382	12.08395	12.04311	0.07500	23165	10.05041	0.02281	14.24344	14.26683	0.02339	12.08395	14.24344	0.015873	0.02134
2000	184751	1608030	12.12676	12.08395	0.07500	23533	10.06616	0.02257	14.26683	14.29052	0.02369	12.12676	14.26683	0.015873	0.02134
2001	192536	1646960	12.16804	12.12676	0.07500	23906	10.08191	0.02179	14.29052	14.31444	0.02392	12.16804	14.29052	0.015873	0.02134
2002	195396	1685517	12.18278	12.16804	0.07500	24286	10.09765	0.01644	14.31444	14.33758	0.02314	12.18278	14.31444	0.015873	0.02134
2003	199594	1724128	12.20404	12.18278	0.07500	24671	10.11340	0.01603	14.33758	14.36023	0.02265	12.20404	14.33758	0.015873	0.02134
2004	205331	1763275	12.23238	12.20404	0.07500	25063	10.12915	0.01594	14.36023	14.38268	0.02245	12.23238	14.36023	0.015873	0.02134
2005	211349	1803011	12.26127	12.23238	0.07500	25461	10.14490	0.01494	14.38268	14.40497	0.02229	12.26127	14.38268	0.015873	0.02134
2006	219554	1843992	12.29935	12.26127	0.07500	25865	10.16065	0.01552	14.40497	14.42744	0.02247	12.29935	14.40497	0.015873	0.02134
2007	228689	1886433	12.34012	12.29935	0.07500	26276	10.17640	0.01527	14.42744	14.45020	0.02275	12.34012	14.42744	0.015873	0.02134
2008	237730	1930215	12.37889	12.34012	0.07500	26693	10.19214	0.01429	14.45020	14.47314	0.02294	12.37889	14.45020	0.015873	0.02134
2009	246828	1975276	12.41645	12.37889	0.07500	27116	10.20789	0.01338	14.47314	14.49622	0.02308	12.41645	14.47314	0.015873	0.02134
2010	256212	2021623	12.45376	12.41645	0.07500	27547	10.22364	0.01261	14.49622	14.51941	0.02319	12.45376	14.49622	0.015873	0.02134
2011	266162	2069346	12.49186	12.45376	0.07500	27984	10.23939	0.01201	14.51941	14.54274	0.02333	12.49186	14.51941	0.015873	0.02134
2012	275373	2118149	12.52588	12.49186	0.07500	28428	10.25514	0.01058	14.54274	14.56605	0.02331	12.52588	14.54274	0.015873	0.02134
2013	284076	2167821	12.55700	12.52588	0.07500	28879	10.27089	0.00920	14.56605	14.58923	0.02318	12.55700	14.56605	0.015873	0.02134
2014	294694	2218851	12.59369	12.55700	0.07500	29338	10.28663	0.00924	14.58923	14.61250	0.02327	12.59369	14.58923	0.015873	0.02134
2015	306449	2271476	12.63281	12.59369	0.07500	29804	10.30238	0.00892	14.61250	14.63594	0.02344	12.63281	14.61250	0.015873	0.02134
2016	318559	2325699	12.67156	12.63281	0.07500	30277	10.31813	0.00819	14.63594	14.65953	0.02359	12.67156	14.63594	0.015873	0.02134

Table D-50
Housing Stock and Price Forecasts
Canada

Programming: Mario Fortin and André Leclerc

Canada

1998-2016

Weak/Weak Scenario: Weak Economic Growth and Weak Demographic Growth

1- GDP growth per adult = 1.00000
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 1 from Statistics Canada (weak growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

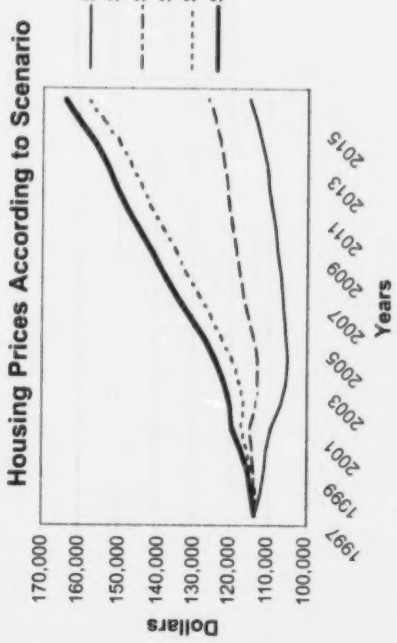
	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		11358769								16.24550					
1997	113593	11508497	11.64038			26970		0.01229	16.24550	16.25860	0.01310	11.64038	16.24550	0.01	
1998	112333	11653820	11.62923	11.64038	0.07500	27240	10.21243	0.01084	16.25860	16.27114	0.01255	11.62923	16.25860	0.01	0.587951
1999	111262	11793018	11.61964	11.62923	0.07500	27512	10.22238	0.00988	16.27114	16.28302	0.01187	11.61964	16.27114	0.01	0.587951
2000	110922	11927931	11.61658	11.61964	0.07500	27787	10.23233	0.00999	16.28302	16.29439	0.01138	11.61658	16.28302	0.01	0.587951
2001	109626	12053349	11.60483	11.61658	0.07500	28065	10.24228	0.00717	16.29439	16.30485	0.01046	11.60483	16.29439	0.01	0.587951
2002	107067	12162871	11.58121	11.60483	0.07500	28346	10.25223	0.00318	16.30485	16.31390	0.00905	11.58121	16.30485	0.01	0.587951
2003	105680	12261963	11.56817	11.58121	0.07500	28629	10.26218	0.00321	16.31390	16.32201	0.00811	11.56817	16.31390	0.01	0.587951
2004	105324	12355706	11.56480	11.56817	0.07500	28915	10.27213	0.00350	16.32201	16.32963	0.00762	11.56480	16.32201	0.01	0.587951
2005	105739	12447957	11.56873	11.56480	0.07500	29205	10.28208	0.00373	16.32963	16.33707	0.00744	11.56873	16.32963	0.01	0.587951
2006	105966	12537768	11.57088	11.56873	0.07500	29497	10.29203	0.00240	16.33707	16.34426	0.00719	11.57088	16.33707	0.01	0.587951
2007	106547	12626942	11.57634	11.57088	0.07500	29792	10.30198	0.00202	16.34426	16.35134	0.00709	11.57634	16.34426	0.01	0.587951
2008	107196	12715816	11.58241	11.57634	0.07500	30090	10.31193	0.00124	16.35134	16.35836	0.00701	11.58241	16.35134	0.01	0.587951
2009	107768	12804004	11.58774	11.58241	0.07500	30390	10.32188	0.00019	16.35836	16.36527	0.00691	11.58774	16.35836	0.01	0.587951
2010	108464	12892138	11.59418	11.58774	0.07500	30694	10.33183	-0.00051	16.36527	16.37213	0.00686	11.59418	16.36527	0.01	0.587951
2011	109557	12982184	11.60420	11.59418	0.07500	31001	10.34179	-0.00064	16.37213	16.37909	0.00696	11.60420	16.37213	0.01	0.587951
2012	110157	13071615	11.60967	11.60420	0.07500	31311	10.35174	-0.00230	16.37909	16.38595	0.00687	11.60967	16.37909	0.01	0.587951
2013	110784	13160580	11.61534	11.60967	0.07500	31624	10.36169	-0.00319	16.38595	16.39274	0.00678	11.61534	16.38595	0.01	0.587951
2014	111987	13251955	11.62613	11.61534	0.07500	31941	10.37164	-0.00303	16.39274	16.39966	0.00692	11.62613	16.39274	0.01	0.587951
2015	113843	13348856	11.64258	11.62613	0.07500	32260	10.38159	-0.00251	16.39966	16.40694	0.00729	11.64258	16.39966	0.01	0.587951
2016	115627	13450660	11.65812	11.64258	0.07500	32583	10.39154	-0.00305	16.40694	16.41454	0.00760	11.65812	16.40694	0.01	0.587951

Table D-51

Housing Stock and Price Forecasts

Canada

Comparison of Results



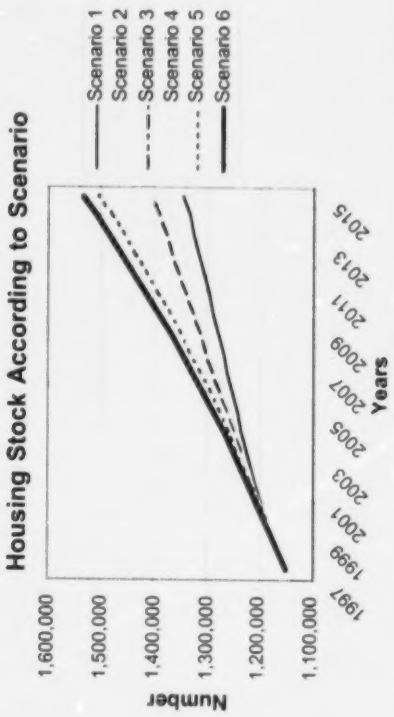


Table D-52
Housing Stock and Price Forecasts
Canada

Canada

1998-2016

Weak/Medium Scenario: Weak Economic Growth and Medium Demographic Growth

1- GDP growth per adult = 1.00000
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 2 from Statistics Canada (medium growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		11358769								16.24550					
1997	113593	11508497	11.64038			26970		0.01229	16.24550	16.25860	0.01310	11.64038	16.24550	0.01000	
1998	113194	11657548	11.63686	11.64038	0.07500	27240	10.21243	0.01245	16.25860	16.27146	0.01287	11.63686	16.25860	0.01000	0.587951
1999	112763	11803241	11.63304	11.63686	0.07500	27512	10.22238	0.01150	16.27146	16.28388	0.01242	11.63304	16.27146	0.01000	0.587951
2000	112893	11946605	11.63419	11.63304	0.07500	27787	10.23233	0.01161	16.28388	16.29596	0.01207	11.63419	16.28388	0.01000	0.587951
2001	112490	12084397	11.63062	11.63419	0.07500	28065	10.24228	0.00990	16.29596	16.30743	0.01147	11.63062	16.29596	0.01000	0.587951
2002	110539	12209060	11.61313	11.63062	0.07500	28346	10.25223	0.00596	16.30743	16.31769	0.01026	11.61313	16.30743	0.01000	0.587951
2003	109581	12325065	11.60442	11.61313	0.07500	28629	10.26218	0.00602	16.31769	16.32715	0.00946	11.60442	16.31769	0.01000	0.587951
2004	109525	12436689	11.60391	11.60442	0.07500	28915	10.27213	0.00633	16.32715	16.33616	0.00902	11.60391	16.32715	0.01000	0.587951
2005	110141	12547161	11.60952	11.60391	0.07500	29205	10.28208	0.00656	16.33616	16.34500	0.00884	11.60952	16.33616	0.01000	0.587951
2006	111025	12657728	11.61751	11.60952	0.07500	29497	10.29203	0.00630	16.34500	16.35378	0.00877	11.61751	16.34500	0.01000	0.587951
2007	112082	12769172	11.62698	11.61751	0.07500	29792	10.30198	0.00597	16.35378	16.36254	0.00877	11.62698	16.35378	0.01000	0.587951
2008	113058	12881046	11.63566	11.62698	0.07500	30090	10.31193	0.00522	16.36254	16.37127	0.00872	11.63566	16.36254	0.01000	0.587951
2009	113836	12992370	11.64252	11.63566	0.07500	30390	10.32188	0.00422	16.37127	16.37987	0.00861	11.64252	16.37127	0.01000	0.587951
2010	114651	13103325	11.64965	11.64252	0.07500	30694	10.33183	0.00355	16.37987	16.38838	0.00850	11.64965	16.37987	0.01000	0.587951
2011	115802	13215525	11.65964	11.64965	0.07500	31001	10.34179	0.00344	16.38838	16.39690	0.00853	11.65964	16.38838	0.01000	0.587951
2012	116403	13326281	11.66481	11.65964	0.07500	31311	10.35174	0.00185	16.39690	16.40525	0.00835	11.66481	16.39690	0.01000	0.587951
2013	116999	13435614	11.66992	11.66481	0.07500	31624	10.36169	0.00101	16.40525	16.41342	0.00817	11.66992	16.40525	0.01000	0.587951
2014	118152	13546248	11.67972	11.66992	0.07500	31941	10.37164	0.00116	16.41342	16.42162	0.00820	11.67972	16.41342	0.01000	0.587951
2015	119938	13661163	11.69473	11.67972	0.07500	32260	10.38159	0.00165	16.42162	16.43007	0.00845	11.69473	16.42162	0.01000	0.587951
2016	121636	13779742	11.70879	11.69473	0.07500	32583	10.39154	0.00112	16.43007	16.43871	0.00864	11.70879	16.43007	0.01000	0.587951

Table D-53
Housing Stock and Price Forecasts
Canada

[redacted]

1998-2016

[redacted]

1- GDP growth per adult = 1.00000
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 3 from Statistics Canada (strong growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation													
[redacted]																
1996		11358769								16.24550						
1997	113593	11508497	11.64038			26970		0.01229	16.24550	16.25860	0.01310	11.64038	16.24550	0.01	
1998	113873	11660473	11.64284	11.64038	0.07500	27240	10.21243	0.01371	16.25860	16.27172	0.01312	11.64284	16.25860	0.01	0.587951
1999	113955	11811274	11.64356	11.64284	0.07500	27512	10.22238	0.01278	16.27172	16.28457	0.01285	11.64356	16.27172	0.01	0.587951
2000	114468	11961301	11.64805	11.64356	0.07500	27787	10.23233	0.01290	16.28457	16.29719	0.01262	11.64805	16.28457	0.01	0.587951
2001	114915	12109389	11.65195	11.64805	0.07500	28065	10.24228	0.01226	16.29719	16.30949	0.01230	11.65195	16.29719	0.01	0.587951
2002	113550	12246916	11.63999	11.65195	0.07500	28346	10.25223	0.00836	16.30949	16.32078	0.01129	11.63999	16.30949	0.01	0.587951
2003	113006	12377452	11.63519	11.63999	0.07500	28629	10.26218	0.00843	16.32078	16.33139	0.01060	11.63519	16.32078	0.01	0.587951
2004	113238	12504543	11.63724	11.63519	0.07500	28915	10.27213	0.00874	16.33139	16.34160	0.01022	11.63724	16.33139	0.01	0.587951
2005	114043	12630836	11.64433	11.63724	0.07500	29205	10.28208	0.00898	16.34160	16.35165	0.01005	11.64433	16.34160	0.01	0.587951
2006	115406	12758873	11.65621	11.64433	0.07500	29497	10.29203	0.00940	16.35165	16.36174	0.01009	11.65621	16.35165	0.01	0.587951
2007	116794	12888662	11.66817	11.65621	0.07500	29792	10.30198	0.00906	16.36174	16.37186	0.01012	11.66817	16.36174	0.01	0.587951
2008	117976	13019151	11.67823	11.66817	0.07500	30090	10.31193	0.00832	16.37186	16.38193	0.01007	11.67823	16.37186	0.01	0.587951
2009	118858	13148911	11.68569	11.67823	0.07500	30390	10.32188	0.00733	16.38193	16.39185	0.00992	11.68569	16.38193	0.01	0.587951
2010	119703	13277773	11.69277	11.68569	0.07500	30694	10.33183	0.00667	16.39185	16.40160	0.00975	11.69277	16.39185	0.01	0.587951
2011	120834	13407091	11.70217	11.69277	0.07500	31001	10.34179	0.00654	16.40160	16.41129	0.00969	11.70217	16.40160	0.01	0.587951
2012	121368	13534057	11.70659	11.70217	0.07500	31311	10.35174	0.00498	16.41129	16.42072	0.00943	11.70659	16.41129	0.01	0.587951
2013	121873	13658596	11.71073	11.70659	0.07500	31624	10.36169	0.00415	16.42072	16.42988	0.00916	11.71073	16.42072	0.01	0.587951
2014	122919	13783331	11.71928	11.71073	0.07500	31941	10.37164	0.00427	16.42988	16.43897	0.00909	11.71928	16.42988	0.01	0.587951
2015	124582	13911145	11.73272	11.71928	0.07500	32260	10.38159	0.00471	16.43897	16.44820	0.00923	11.73272	16.43897	0.01	0.587951
2016	126145	14041438	11.74519	11.73272	0.07500	32583	10.39154	0.00416	16.44820	16.45752	0.00932	11.74519	16.44820	0.01	0.587951

Table D-54
Housing Stock and Price Forecasts
Canada

Canada

1998-2016

Medium/Weak Scenario: Medium Economic Growth and Weak Demographic Growth

1- GDP growth per adult = 1.64720
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 1 from Statistics Canada (weak growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		11358769								16.24550					
1997	113593	11508497	11.64038			26970		0.01229	16.24550	16.25860	0.01310	11.64038	16.24550	0.01647	
1998	112939	11658277	11.63460	11.64038	0.07500	27414	10.21882	0.01084	16.25860	16.27153	0.01293	11.63460	16.25860	0.01647	0.587951
1999	112912	11807541	11.63436	11.63460	0.07500	27866	10.23516	0.00988	16.27153	16.28425	0.01272	11.63436	16.27153	0.01647	0.587951
2000	113947	11959041	11.64349	11.63436	0.07500	28325	10.25149	0.00999	16.28425	16.29700	0.01275	11.64349	16.28425	0.01647	0.587951
2001	114223	12108201	11.64590	11.64349	0.07500	28791	10.26783	0.00717	16.29700	16.30939	0.01240	11.64590	16.29700	0.01647	0.587951
2002	113295	12248954	11.63775	11.64590	0.07500	29266	10.28417	0.00318	16.30939	16.32095	0.01156	11.63775	16.30939	0.01647	0.587951
2003	113655	12386913	11.64093	11.63775	0.07500	29748	10.30051	0.00321	16.32095	16.33215	0.01120	11.64093	16.32095	0.01647	0.587951
2004	115166	12527172	11.65413	11.64093	0.07500	30238	10.31685	0.00350	16.33215	16.34341	0.01126	11.65413	16.33215	0.01647	0.587951
2005	117560	12673504	11.67471	11.65413	0.07500	30736	10.33318	0.00373	16.34341	16.35502	0.01161	11.67471	16.34341	0.01647	0.587951
2006	119770	12824735	11.69333	11.67471	0.07500	31242	10.34952	0.00240	16.35502	16.36689	0.01186	11.69333	16.35502	0.01647	0.587951
2007	122389	12982430	11.71496	11.69333	0.07500	31757	10.36586	0.00202	16.36689	16.37911	0.01222	11.71496	16.36689	0.01647	0.587951
2008	125088	13146634	11.73677	11.71496	0.07500	32280	10.38220	0.00124	16.37911	16.39168	0.01257	11.73677	16.37911	0.01647	0.587951
2009	127688	13316619	11.75735	11.73677	0.07500	32811	10.39853	0.00019	16.39168	16.40452	0.01285	11.75735	16.39168	0.01647	0.587951
2010	130420	13492705	11.77852	11.75735	0.07500	33352	10.41487	-0.00051	16.40452	16.41766	0.01314	11.77852	16.40452	0.01647	0.587951
2011	133618	13676633	11.80274	11.77852	0.07500	33901	10.43121	-0.00064	16.41766	16.43120	0.01354	11.80274	16.41766	0.01647	0.587951
2012	136201	13865445	11.82189	11.80274	0.07500	34460	10.44755	-0.00230	16.43120	16.44491	0.01371	11.82189	16.43120	0.01647	0.587951
2013	138793	14058983	11.84074	11.82189	0.07500	35027	10.46389	-0.00319	16.44491	16.45877	0.01386	11.84074	16.44491	0.01647	0.587951
2014	142092	14260045	11.86423	11.84074	0.07500	35604	10.48022	-0.00303	16.45877	16.47297	0.01420	11.86423	16.45877	0.01647	0.587951
2015	146229	14471805	11.89293	11.86423	0.07500	36191	10.49656	-0.00251	16.47297	16.48771	0.01474	11.89293	16.47297	0.01647	0.587951
2016	150290	14693479	11.92032	11.89293	0.07500	36787	10.51290	-0.00305	16.48771	16.50291	0.01520	11.92032	16.48771	0.01647	0.587951

Table D-55
Housing Stock and Price Forecasts
Canada

[redacted]

Canada

1998-2016

Medium/Medium Scenario: Medium Economic Growth and Medium Demographic Growth

1- GDP growth per adult = 1.64720
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 2 from Statistics Canada (medium growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25,54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		11358769								16.24550					
1997	113593	11508497	11.64038			26970		0.01229	16.24550	16.25860	0.01310	11.64038	16.24550	0.016472	
1998	113804	11662006	11.64223	11.64038	0.07500	27414	10.2188182	0.01245	16.25860	16.27185	0.01325	11.64223	16.25860	0.016472	0.587951
1999	114435	11817777	11.64776	11.64223	0.07500	27866	10.235156	0.01150	16.27185	16.28512	0.01327	11.64776	16.27185	0.016472	0.587951
2000	115972	11977764	11.66110	11.64776	0.07500	28325	10.2514938	0.01161	16.28512	16.29856	0.01345	11.66110	16.28512	0.016472	0.587951
2001	117207	12139391	11.67170	11.66110	0.07500	28791	10.2678316	0.00990	16.29856	16.31197	0.01340	11.67170	16.29856	0.016472	0.587951
2002	116969	12295470	11.66966	11.67170	0.07500	29266	10.2841695	0.00596	16.31197	16.32474	0.01278	11.66966	16.31197	0.016472	0.587951
2003	117851	12450658	11.67717	11.66966	0.07500	29748	10.3005073	0.00602	16.32474	16.33728	0.01254	11.67717	16.32474	0.016472	0.587951
2004	119760	12609279	11.69324	11.67717	0.07500	30238	10.3168451	0.00633	16.33728	16.34994	0.01266	11.69324	16.33728	0.016472	0.587951
2005	122454	12774505	11.71549	11.69324	0.07500	30736	10.3331829	0.00656	16.34994	16.36296	0.01302	11.71549	16.34994	0.016472	0.587951
2006	125488	12947440	11.73996	11.71549	0.07500	31242	10.3495207	0.00630	16.36296	16.37641	0.01345	11.73996	16.36296	0.016472	0.587951
2007	128747	13128664	11.76560	11.73996	0.07500	31757	10.3658585	0.00597	16.37641	16.39031	0.01390	11.76560	16.37641	0.016472	0.587951
2008	131928	13317461	11.79001	11.76560	0.07500	32280	10.3821963	0.00522	16.39031	16.40459	0.01428	11.79001	16.39031	0.016472	0.587951
2009	134878	13512526	11.81213	11.79001	0.07500	32811	10.3985341	0.00422	16.40459	16.41913	0.01454	11.81213	16.40459	0.016472	0.587951
2010	137859	13713730	11.83399	11.81213	0.07500	33352	10.4148719	0.00355	16.41913	16.43391	0.01478	11.83399	16.41913	0.016472	0.587951
2011	141235	13922456	11.85818	11.83399	0.07500	33901	10.4312097	0.00344	16.43391	16.44901	0.01511	11.85818	16.43391	0.016472	0.587951
2012	143923	14135577	11.87704	11.85818	0.07500	34460	10.4475475	0.00185	16.44901	16.46421	0.01519	11.87704	16.44901	0.016472	0.587951
2013	146579	14352792	11.89532	11.87704	0.07500	35027	10.4638853	0.00101	16.46421	16.47946	0.01525	11.89532	16.46421	0.016472	0.587951
2014	149914	14576726	11.91782	11.89532	0.07500	35604	10.4802232	0.00116	16.47946	16.49494	0.01548	11.91782	16.47946	0.016472	0.587951
2015	154058	14810384	11.94508	11.91782	0.07500	36191	10.496561	0.00165	16.49494	16.51084	0.01590	11.94508	16.49494	0.016472	0.587951
2016	158101	15052968	11.97099	11.94508	0.07500	36787	10.5128988	0.00112	16.51084	16.52709	0.01625	11.97099	16.51084	0.016472	0.587951

Table D-56
Housing Stock and Price Forecasts
Canada

Canada

1998-2016

Medium-Strong Scenario: Medium Economic Growth and Strong Demographic Growth

1- GDP growth per adult = 1.64720
2- Five-year mortgage loan interest rate = 7.50
3- Demographic projections = scenario 3 from Statistics Canada (strong growth)

Legend
Pt: MLS price divided by the consumer price index
Rt: interest rate on 5-year residential mortgages
Yt: GDP ratio for the population 15 years of age and over
N(25,54)t: number of persons between the ages of 25 and 54
St: housing stock

	Forecasts		Price Equation								Housing Stock Variation Equation				
Years	Pt	St	Ln Pt	Ln Pt-1	Rt	Yt	Ln Yt	Var N(25, 54)t	Ln St-1	Ln St	Var Ln St	Ln Pt	Ln St-1	Var Yt	AR(1)
1996		11358769								16.24550					
1997	113593	11508497	11.64038			26970		0.01229	16.24550	16.25860	0.01310	11.64038	16.24550	0.01647	
1998	114487	11664933	11.64822	11.64038	0.07500	27414	10.21882	0.01371	16.25860	16.27210	0.01350	11.64822	16.25860	0.01647	0.587951
1999	115645	11825820	11.65828	11.64822	0.07500	27866	10.23516	0.01278	16.27210	16.28580	0.01370	11.65828	16.27210	0.01647	0.587951
2000	117590	11992498	11.67496	11.65828	0.07500	28325	10.25149	0.01290	16.28580	16.29979	0.01400	11.67496	16.28580	0.01647	0.587951
2001	119733	12164497	11.69302	11.67496	0.07500	28791	10.26783	0.01226	16.29979	16.31403	0.01424	11.69302	16.29979	0.01647	0.587951
2002	120154	12333594	11.69653	11.69302	0.07500	29266	10.28417	0.00836	16.31403	16.32784	0.01381	11.69653	16.31403	0.01647	0.587951
2003	121534	12503579	11.70795	11.69653	0.07500	29748	10.30051	0.00843	16.32784	16.34153	0.01369	11.70795	16.32784	0.01647	0.587951
2004	123820	12678074	11.72658	11.70795	0.07500	30238	10.31685	0.00874	16.34153	16.35538	0.01386	11.72658	16.34153	0.01647	0.587951
2005	126793	12859697	11.75031	11.72658	0.07500	30736	10.33318	0.00898	16.35538	16.36961	0.01422	11.75031	16.35538	0.01647	0.587951
2006	130440	13050901	11.77867	11.75031	0.07500	31242	10.34952	0.00940	16.36961	16.38437	0.01476	11.77867	16.36961	0.01647	0.587951
2007	134160	13251519	11.80679	11.77867	0.07500	31757	10.36586	0.00906	16.38437	16.39962	0.01525	11.80679	16.38437	0.01647	0.587951
2008	137667	13460246	11.83259	11.80679	0.07500	32280	10.38220	0.00832	16.39962	16.41525	0.01563	11.83259	16.39962	0.01647	0.587951
2009	140828	13675335	11.85530	11.83259	0.07500	32811	10.39853	0.00733	16.41525	16.43110	0.01585	11.85530	16.41525	0.01647	0.587951
2010	143934	13896304	11.87711	11.85530	0.07500	33352	10.41487	0.00667	16.43110	16.44713	0.01603	11.87711	16.43110	0.01647	0.587951
2011	147372	14124270	11.90072	11.87711	0.07500	33901	10.43121	0.00654	16.44713	16.46341	0.01627	11.90072	16.44713	0.01647	0.587951
2012	150063	14355971	11.91881	11.90072	0.07500	34460	10.44755	0.00498	16.46341	16.47968	0.01627	11.91881	16.46341	0.01647	0.587951
2013	152684	14590996	11.93613	11.91881	0.07500	35027	10.46389	0.00415	16.47968	16.49592	0.01624	11.93613	16.47968	0.01647	0.587951
2014	155963	14831844	11.95737	11.93613	0.07500	35604	10.48022	0.00427	16.49592	16.51229	0.01637	11.95737	16.49592	0.01647	0.587951
2015	160023	15081396	11.98307	11.95737	0.07500	36191	10.49656	0.00471	16.51229	16.52897	0.01669	11.98307	16.51229	0.01647	0.587951
2016	163962	15338844	12.00739	11.98307	0.07500	36787	10.51290	0.00416	16.52897	16.54590	0.01693	12.00739	16.52897	0.01647	0.587951

Table D-57-1
Data on the Housing Market in Canada
1956-1997

Data on the Housing Market in Canada

Years	Consumer Price Index CPI	MLS Canada Prices MLSTOTAL	MLS Canada Prices (real) MLSTOTALR	New Home Price Index NHPI	New Home Price Index (real) NHPIR	National Housing Act Price NHA	National Housing Act Price (real) NHAR	National Balance Sheet Accounts NBSA	National Balance Sheet Accounts (real) NBSAR	Stock-weighted MLS Prices WEIG.MLS	Stock-weighted MLS Prices (real) WEIG.MLSR	Construction Costs Index CONSTRUCPI
1956	21.84	11,993	54,909	NA	NA	13,548	62,028	NA	NA	NA	NA	NA
1957	22.54	12,781	56,699	NA	NA	14,044	62,302	NA	NA	NA	NA	NA
1958	23.11	13,823	59,818	NA	NA	14,267	61,740	NA	NA	NA	NA	NA
1959	23.38	14,208	60,761	NA	NA	14,462	61,847	NA	NA	NA	NA	NA
1960	23.68	14,186	59,920	NA	NA	14,273	60,287	NA	NA	15,930	67,286	NA
1961	23.92	14,127	59,068	NA	NA	14,463	60,472	6,073	25,393	16,239	67,898	NA
1962	24.18	14,303	59,144	NA	NA	14,684	60,720	6,268	25,921	16,418	67,890	NA
1963	24.60	14,420	58,618	NA	NA	15,068	61,252	6,616	26,894	16,573	67,370	NA
1964	25.05	15,064	60,136	NA	NA	15,807	63,102	7,080	28,262	16,836	67,210	NA
1965	25.68	15,917	61,974	NA	NA	16,572	64,524	7,652	29,794	17,291	67,324	NA
1966	26.63	17,536	65,863	NA	NA	18,059	67,827	8,231	30,915	18,553	69,683	NA
1967	27.58	19,111	69,306	NA	NA	18,529	67,195	8,689	31,512	19,908	72,196	NA
1968	28.69	21,272	74,140	NA	NA	18,922	65,949	9,171	31,965	21,567	75,168	NA
1969	29.99	23,234	77,468	NA	NA	20,315	67,735	9,771	32,580	22,858	76,215	NA
1970	30.99	23,376	75,427	NA	NA	19,894	64,191	10,424	33,636	23,159	74,727	NA
1971	31.88	24,581	77,117	36.10	113.25	20,528	64,402	11,486	36,035	24,264	76,122	33.30
1972	33.41	26,595	79,606	39.60	118.53	22,168	66,355	13,313	39,849	26,195	78,409	36.18
1973	35.95	32,306	89,864	48.20	134.08	24,370	67,789	15,968	44,418	30,740	85,508	42.45
1974	39.88	41,057	102,964	61.80	154.98	28,683	71,932	18,235	45,731	38,855	97,442	51.13
1975	44.16	45,878	103,894	65.90	149.24	33,289	75,386	20,073	45,457	42,782	96,883	54.88
1976	47.47	51,359	108,200	72.00	151.69	37,877	79,797	21,867	46,069	47,988	101,098	59.45
1977	51.28	53,888	105,096	74.40	145.10	41,542	81,018	23,375	45,587	50,350	98,196	61.53
1978	55.85	56,637	101,409	76.40	136.80	44,055	78,881	25,400	45,479	53,226	95,302	64.93
1979	60.96	62,485	102,504	79.20	129.92	49,024	80,422	27,756	45,533	58,413	95,824	69.50
1980	67.16	70,238	104,586	85.40	127.16	54,673	81,409	30,837	45,918	64,091	95,433	75.35
1981	75.52	79,535	105,321	95.77	126.82	63,370	83,915	33,650	44,559	74,370	98,482	84.03
1982	83.68	73,158	87,431	93.79	112.09	64,097	76,602	35,361	42,260	68,646	82,039	85.53
1983	88.54	77,361	87,372	90.69	102.42	68,881	77,795	37,318	42,148	72,194	81,537	88.05
1984	92.38	76,948	83,292	91.05	98.55	74,707	80,866	39.093	42,317	73,353	79,401	90.35
1985	96.03	81,845	85,226	92.10	95.90	80,616	83,946	41,531	43,246	78,280	81,513	92.80
1986	100.04	95,074	95,034	100.00	99.96	NA	NA	45,624	45,605	90,087	90,049	100.00
1987	104.41	111,673	106,958	113.84	109.04	NA	NA	50,320	48,195	106,679	102,175	111.08

Table D-57-2
Data on the Housing Market in Canada
1956-1997

Data on the Housing Market in Canada

Years	Consumer Price Index CPI	MLS Canada Prices MLSTOTAL	MLS Canada Prices (real) MLSTOTALR	New Home Price Index NHPI	New Home Price Index (real) NHPIR	National Housing Act Price NHA	National Housing Act Price (real) NHAR	National Balance Sheet Accounts NBSA	Balance Sheet Accounts (real) NBSAR	Stock-weighted MLS Prices WEIG.MLS	Stock-weighted MLS Prices (real) WEIG.MLSR	Construction Costs Index CONSTRUCPI
1988	108.61	130,724	120,363	125.56	115.61	NA	NA	54,456	50,140	122,017	112,346	120.50
1989	114.03	146,127	128,144	142.17	124.68	NA	NA	57,443	50,374	135,744	119,039	129.55
1990	119.47	139,214	116,530	144.24	120.74	NA	NA	59,255	49,600	131,714	110,252	128.78
1991	126.18	145,516	115,329	134.34	106.47	NA	NA	60,843	48,221	132,506	105,018	131.05
1992	128.08	147,933	115,505	134.31	104.87	NA	NA	62,754	48,998	131,484	102,662	131.33
1993	130.43	151,413	116,085	136.08	104.33	NA	NA	65,132	49,935	132,820	101,830	133.73
1994	130.68	157,440	120,482	136.27	104.28	NA	NA	66,971	51,250	137,339	105,100	137.05
1995	133.51	150,591	112,795	134.68	100.88	NA	NA	67,650	50,671	134,275	100,574	137.98
1996	135.59	151,436	111,685	132.10	97.42	NA	NA	68,405	50,450	135,272	99,764	138.03
1997	137.80	156,531	113,593	133.13	96.61	NA	NA	69,851	50,690	142,046	103,081	140.95

Table D-57-3
Data on the Housing Market in Canada
1956-1997

Data on the Housing Market in Canada

Year	Construction Costs Index (real) CONSTRUCPIR	Interest Rate on 5-year Mortgages 5YMOR.R	Annual Variation Rate of CPI INF	Housing Use Cost USER5	Number of Housing Units STOCK	Rate of Housing Units VACR	Pop. Growth 15-24 PG1524	Pop. Growth 25-34 PG2534	Pop. Growth 35-44 PG3544	Pop. Growth 45-54 PG4554	Pop. Growth 55-64 PG5564	Pop. Growth 65 and Over PG65O	Pop. Growth 25-54 PG2544	Income per Adult IA
1956	NA	6.23%	1.43%	7.46%	4,159,168	3.57%	NA	NA	NA	NA	NA	NA	NA	14,118
1957	NA	6.85%	3.20%	9.71%	4,274,322	3.66%	3.49%	2.15%	2.86%	3.41%	2.04%	2.11%	2.48%	13,986
1958	NA	6.80%	2.51%	7.89%	4,422,259	3.76%	2.89%	0.92%	2.41%	3.03%	1.83%	1.95%	1.62%	13,967
1959	NA	6.98%	1.19%	8.72%	4,566,260	3.87%	2.08%	0.19%	2.21%	3.45%	2.68%	2.61%	1.14%	14,256
1960	NA	7.18%	1.25%	10.19%	4,686,112	3.98%	2.49%	-0.14%	1.95%	2.98%	2.39%	2.18%	0.86%	14,349
1961	NA	7.00%	1.02%	10.00%	4,794,776	4.04%	2.49%	-0.37%	1.74%	2.68%	2.28%	2.46%	0.65%	14,546
1962	NA	6.97%	1.12%	10.21%	4,911,233	4.07%	4.30%	-0.88%	1.40%	2.19%	2.64%	2.00%	0.23%	15,261
1963	NA	6.97%	1.72%	10.11%	5,025,385	4.09%	4.88%	-0.88%	1.17%	1.95%	2.54%	2.04%	0.13%	15,717
1964	NA	6.97%	1.83%	9.50%	5,164,738	4.11%	5.09%	-0.14%	1.34%	1.90%	2.73%	2.01%	0.60%	16,379
1965	NA	7.02%	2.53%	9.44%	5,308,036	4.13%	4.69%	0.51%	1.22%	2.05%	2.98%	2.00%	0.87%	17,023
1966	NA	7.66%	3.67%	9.22%	5,469,090	4.17%	4.77%	1.51%	1.12%	2.12%	3.06%	2.18%	1.31%	17,677
1967	NA	8.07%	3.57%	8.38%	5,618,358	4.25%	5.06%	2.23%	0.57%	2.18%	3.41%	2.30%	1.39%	17,669
1968	NA	9.06%	4.05%	9.23%	5,790,182	4.34%	4.43%	2.56%	0.01%	2.11%	3.42%	2.27%	1.29%	18,079
1969	NA	9.84%	4.53%	9.33%	5,991,958	4.44%	3.75%	3.06%	-0.39%	2.09%	3.41%	2.60%	1.36%	18,527
1970	NA	10.45%	3.33%	9.30%	6,175,500	4.55%	3.50%	3.61%	-0.44%	1.94%	3.09%	2.61%	1.65%	18,485
1971	104.47	9.43%	2.85%	9.74%	6,375,126	4.34%	3.01%	4.50%	-0.20%	1.94%	2.50%	2.61%	2.27%	19,064
1972	108.28	9.21%	4.81%	10.06%	6,593,945	4.88%	1.69%	5.35%	-0.15%	1.96%	1.97%	2.56%	2.81%	19,695
1973	118.08	9.59%	7.61%	8.39%	6,825,113	5.29%	2.22%	4.80%	0.12%	2.05%	1.66%	2.63%	2.70%	20,711
1974	128.21	11.24%	10.92%	6.82%	7,066,430	5.40%	2.67%	4.71%	0.69%	1.70%	1.80%	2.67%	2.95%	21,034
1975	124.27	11.43%	10.74%	3.65%	7,270,292	5.03%	2.64%	4.47%	0.76%	1.04%	2.59%	2.77%	2.88%	21,012
1976	125.25	11.78%	7.49%	4.09%	7,500,633	5.13%	2.30%	3.85%	1.17%	0.67%	2.53%	3.31%	2.73%	21,706
1977	119.99	10.36%	8.02%	6.28%	7,741,213	5.45%	1.41%	3.51%	1.82%	0.20%	2.84%	3.31%	2.81%	22,016
1978	116.25	10.59%	8.92%	5.92%	7,967,345	5.69%	1.18%	2.78%	2.50%	0.33%	2.33%	3.16%	2.66%	22,576
1979	114.01	11.98%	9.15%	6.06%	8,186,087	5.41%	0.91%	2.72%	3.08%	-0.11%	1.98%	3.46%	2.87%	23,007
1980	112.20	14.32%	10.17%	7.59%	8,355,747	4.54%	0.87%	3.25%	3.29%	0.07%	1.99%	3.36%	3.27%	22,887
1981	111.27	18.15%	12.45%	9.44%	8,534,475	4.39%	0.14%	2.55%	3.74%	0.22%	2.23%	3.09%	3.04%	23,308
1982	102.21	17.89%	10.80%	6.97%	8,667,917	4.16%	-1.22%	1.95%	5.28%	0.35%	2.23%	2.73%	3.32%	22,213
1983	99.44	13.29%	5.82%	5.17%	8,845,182	4.37%	-1.83%	1.89%	4.50%	0.27%	2.34%	2.38%	2.98%	22,613
1984	97.80	13.61%	4.34%	10.39%	9,011,212	4.29%	-1.92%	1.87%	3.92%	0.59%	1.94%	2.64%	2.74%	23,738
1985	96.63	12.18%	3.95%	10.80%	9,167,257	4.10%	-1.92%	1.92%	3.73%	0.44%	1.17%	3.32%	2.70%	24,558
1986	99.96	11.22%	4.17%	10.47%	9,364,818	4.11%	-1.81%	2.08%	3.57%	1.02%	0.92%	3.32%	2.73%	25,055
1987	106.39	11.14%	4.36%	10.18%	9,599,434	4.32%	-2.59%	2.31%	3.74%	1.89%	0.74%	3.66%	2.94%	25,779

Table D-57-4
Data on the Housing Market in Canada
1956-1997

Data on the Housing Market in Canada

Year	Construction Costs Index (real) CONSTRUCPIR	Interest Rate on 5-year Mortgages 5YMOR.R	Annual Variation Rate of CPI INF	Housing Use Cost USER5	Number of Housing Units STOCK	Vacancy Rate of Housing Units VACR	Pop. Growth 15-24 PG1524	Pop. Growth 25-34 PG2534	Pop. Growth 35-44 PG3544	Pop. Growth 45-54 PG4554	Pop. Growth 55-64 PG5564	Pop. Growth 65 and Over PG65O	Pop. Growth 25-54 PG2544	Income per Adult IA
1988	110.95	11.60%	4.02%	10.34%	9,832,612	4.39%	-2.85%	1.97%	3.56%	2.85%	0.70%	3.04%	2.67%	26,726
1989	113.61	12.05%	5.00%	11.02%	10,062,178	4.58%	-1.93%	2.27%	4.16%	3.54%	0.29%	3.26%	3.11%	27,017
1990	107.79	13.24%	4.76%	10.94%	10,280,902	4.70%	-1.59%	0.82%	3.84%	3.39%	0.28%	3.05%	2.18%	26,561
1991	103.86	11.16%	5.62%	9.60%	10,470,501	5.03%	-1.14%	-0.53%	2.99%	3.92%	0.37%	3.02%	1.08%	25,682
1992	102.54	9.52%	1.51%	7.52%	10,685,540	5.22%	-0.10%	-0.27%	2.29%	5.84%	0.57%	2.80%	0.93%	25,439
1993	102.52	8.70%	1.84%	11.02%	10,870,036	5.19%	0.05%	-0.85%	2.53%	5.33%	0.65%	2.67%	0.75%	25,556
1994	104.88	9.34%	0.19%	11.16%	11,071,816	5.24%	-0.29%	-1.68%	2.18%	4.74%	1.14%	2.45%	0.18%	26,192
1995	103.35	9.22%	2.17%	12.73%	11,226,462	5.36%	0.16%	-1.20%	2.59%	4.59%	1.03%	2.48%	0.66%	26,440
1996	101.79	7.94%	1.56%	9.79%	11,358,769	5.27%	0.31%	-1.35%	2.58%	4.12%	1.42%	2.40%	0.61%	26,456
1997	102.29	7.07%	1.63%	9.74%	11,508,497	5.26%	0.43%	-1.88%	2.27%	3.79%	1.76%	2.25%	0.24%	26,970